A

MANUAL OF LITHOGRAPHY,

OR

Memoir

ON THE

LITHOGRAPHICAL EXPERIMENTS

MADE IN PARIS,

AT THE

ROYAL SCHOOL OF THE ROADS AND BRIDGES;

CLEARLY EXPLAINING THE WHOLE ART, AS WELL AS ALL THE ACCIDENTS THAT MAY HAPPEN IN PRINTING, AND THE DIFFERENT METHODS OF AVOIDING THEM.

TRANSLATED FROM THE FRENCH,

BY C. HULLMANDEL.

LONDON:
PRINTED FOR RODWELL AND MARTIN,
NEW BOND-STREET.

1820.

LONDON:
PRINTED BY THOMAS DAVISON, WHITEFRIARS.

PREFACE.

ORIGIN AND PROGRESS OF LITHOGRAPHY.

ALOYS SENNEFELDER, an actor of one of the theatres in Munich, was the first to observe that calcareous stones had the property of receiving greasy lines, and transmitting them to paper. He remarked that, by wetting the stone, it was possible to charge it again with ink, and obtain a series of impressions: he thus became the inventor of Lithography.

It was very natural that the city where this art was invented should also be the place where it was practised with most success. The ingenious inventor obtained in 1800 the exclusive privilege of exercising his art.

It is said that Mr. Mitterer, a professor of the public school for drawing, invented the composition of the chalk; and Messrs. Manlich and Aretin set up some lithographic presses, chiefly destined for the production of objects of fine arts, and published the greatest part of the admirable collection of the drawings of ancient masters, belonging to the King of Bavaria.

In 1801 lithography was spread all over Germany; but in Austria it was only in 1802 that Sennefelder himself set up an establishment in Vienna.

In 1807 Mr. André, of Offenbach, who had become a partner of Sennefelder's, tried, but unsuccessfully, to establish presses in London and Paris, while Mr. Dalarmé, of Munich, settled in Milan and Rome.

Hitherto lithography had been kept a profound secret; and in 1810 Mr. Manlich

could not obtain permission from the government to set up an establishment in Paris: and we might still be completely in the dark with regard to this new art, had not Mr. Marcel de Serres, who was examining the manufactories in Germany, by order of the French government, published in 1814 some observations on lithography.

As Mr. Marcel explained, with his usual talent, the process of lithography, this Memoir attracted the attention of men of science: it was read with interest; and, so far as concerns theory, his treatise was complete; but when applications were made, it was found far from being perfect. The real secrets of lithography exist in the process of printing, and of course the Germans were not inclined to initiate a foreigner in them: there exists besides, as in every other art, certain minutiæ in the

practical part of it which habit alone can give, and can be explained only by a person who has had the courage to become himself a printer.

Count Lasteyrie was distinguished as one of the most active persons in attempting to introduce lithography in France. He performed several journies into Germany for the sole purpose of obtaining information. He became a lithographer himself, procured printers from Germany, and announced his intention of publishing a complete treatise on this new art.

In the interim Mr. Englemann, who had a lithographic establishment at Mulhausen, settled in Paris; and as he perfectly understood the practical part, he soon produced perfect specimens, by which he obtained an honourable mention from the class of fine arts of the Institute.

Count Lasteyrie was also highly suc-

cessful; but as his establishment had cost him a considerable sum, it was natural that he should employ lithography as the means of covering his expenses; and this art having once become with him an object of speculation, he thought it right not to make his treatise public: thus Paris possessed two considerable lithographic establishments.

Unfortunately for the progress of lithography, instead of mutually communicating to each other the discoveries which they made, both Englemann and Lasteyrie became jealous of one another, and made a secret of the whole process.

At this time the committee of the school of the royal roads and bridges obtained from the director-general the permission of establishing a lithographic press: as I was then one of the oldest of the pupils, I was intrusted with the management of the

establishment. I was at first completely in the dark. Mr. Berigny received from a learned German several notes and explanations, which I had in vain attempted to obtain from my own countrymen; but, nevertheless, it was only after continued failures, during more than a year, that I began to comprehend the different phænomena which so frequently occur in lithography, and continually perplex the printer.

As no person could feel better than myself the service that would have been done to me if I had been spared by advice the laborious researches I was obliged to make, I was happy to impart to every inquirer those observations which were the fruit of self-taught experience. I was always in hopes that some liberal person would have given to the public a description of the whole process of lithography; but two

years have elapsed, and nobody has stepped forward, although the number of lithographers has considerably increased. I thus happen to be, perhaps, the only man in France who has made a serious occupation of lithography, and who has no motive to make a secret of it; and the silence which other persons have hitherto maintained encourages me still more to lay my observations before the public.

Lithography has been seventeen years in travelling from Munich to Paris, and an equal lapse of time might probably ensue before it were generally spread throughout France. I am too much impressed with its importance and its utility to the fine arts, public instruction, manufactures, and the different branches of administration, not to be desirous of seeing its use extend throughout the kingdom.

However short this Memoir may be, I

have thought it right to divide it in several parts: the first will contain the preparation of the inks, varnishes, &c.; the second, a description of the necessary implements; the third will explain the process of printing; and the fourth, and last, different applications of lithography.

TRANSLATOR'S PREFACE.

THE art of lithography, when not sufficiently understood, is so subject to failures, that a sure guide has long been wanted to explain all the phænomena that continually occur during the course of the printing, and which repeatedly spoil the stones. These failures have hitherto deterred many artists from trying their skill in lithography. In France, however, Lithographers are become almost certain of success, and several admirable specimens produced in that country show to what a high degree of perfection this art may be carried.

The books which have hitherto been published on lithography are very im-

perfect, and are much more adapted to persons who already understand the art than to those who wish to learn it: they explain, it is true, the different styles to which lithography may be applied, and the preparation of the chalks, inks, and stones, but give no clue to the labyrinth in which a beginner is soon bewildered, when he once attempts the practical part of printing from stone. I myself have, like Mr. Raucourt, had to encounter all the difficulties he has met with, and have failed often for months together, without being able to assign any probable cause; like him, I have repeatedly wished for a guide to explain the new accidents which occur every instant, and which, when not previously explained, appear each time so new and intricate, that the beginner is continually tempted to give up all hopes of ever succeeding. I am consequently better

enabled to appreciate the value of this excellent treatise on lithography, and hesitate not an instant to pronounce it the best work which has ever been published on this art. I had long found out that the whole success of the printing depended on the nature of the inks which were employed, but could form no distinct notion as to the system which it was necessary to follow, and it is chiefly in this respect that the great superiority of his work appears: his theory of the inks is as new and ingenious as it is true; and his observations on the management of the rollers are equally important.

The clearness and method with which Mr. Raucourt has written on lithography are such, that any person, by reading this short treatise, may after a few trials be certain of success; and I am confident that by thus presenting to the public his ob-

servations in an English dress, I am forwarding the progress of this new and highly useful art, and saving to those who wish to study and practise it much trouble and loss of time.

It now remains for me to request the indulgence of the reader for the numerous repetitions which he will meet with in the course of this translation; but he must remember that clearness is the first requisite in a work of this kind, and that, in a treatise composed entirely of recipes and rules, it was impossible, in order to be well understood, to avoid a repeated use of the same words.

C. HULLMANDEL.

London, Dec. 10, 1819.

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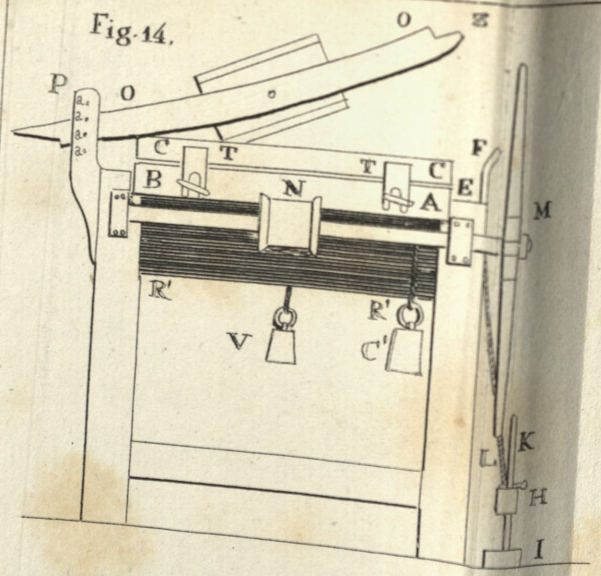

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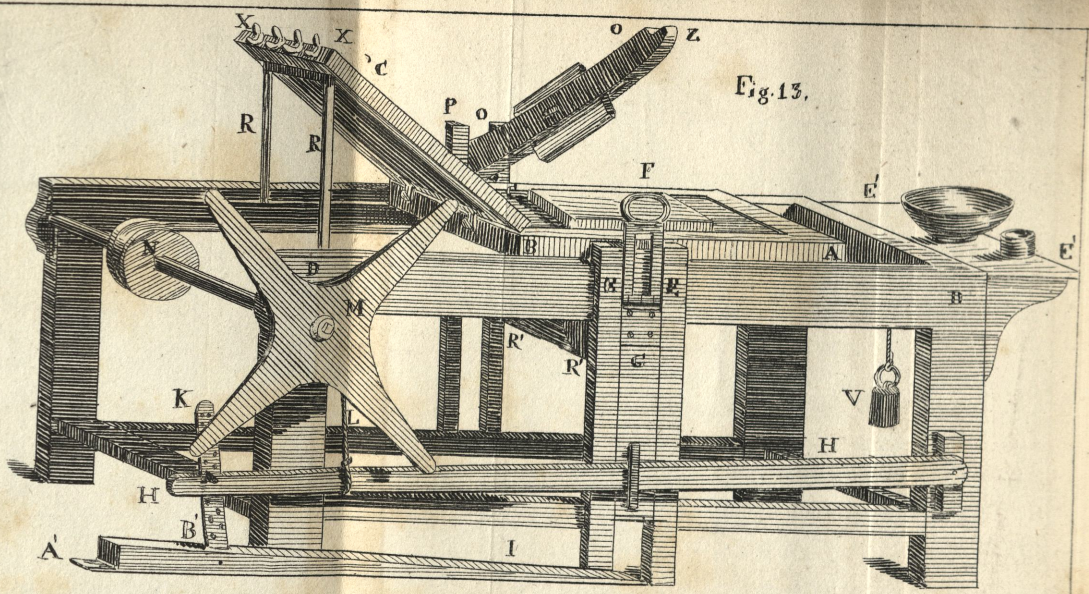

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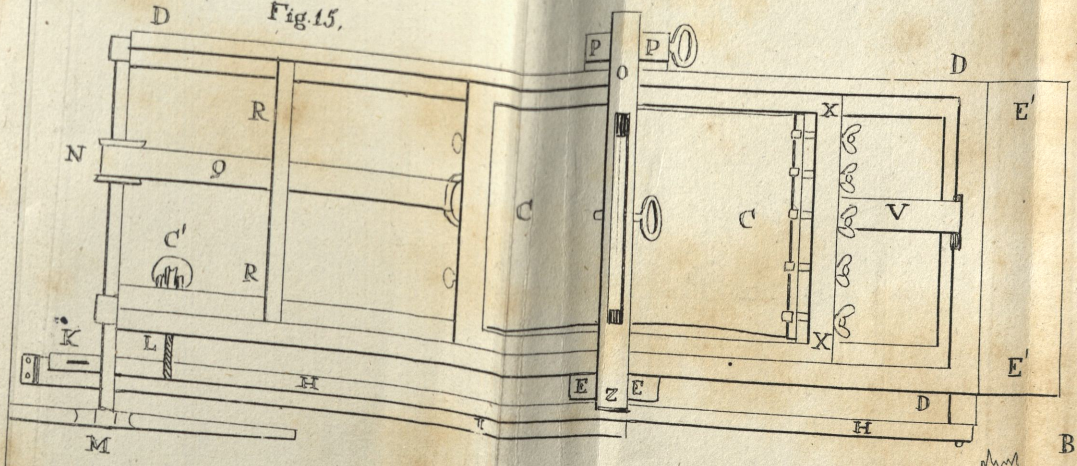

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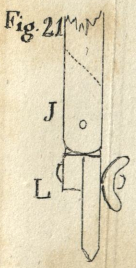

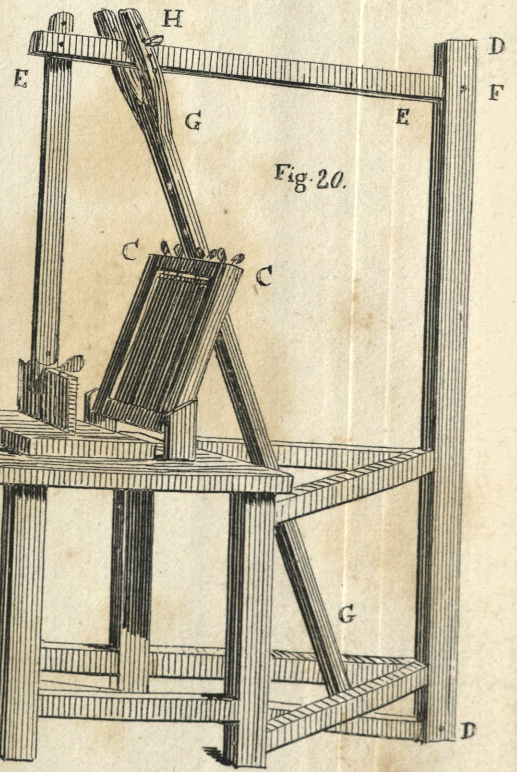

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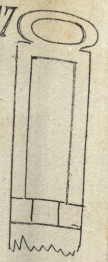

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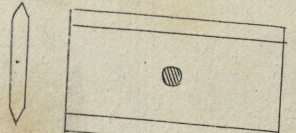

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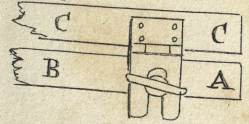

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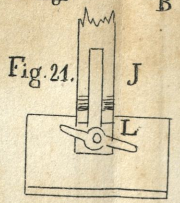

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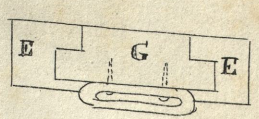

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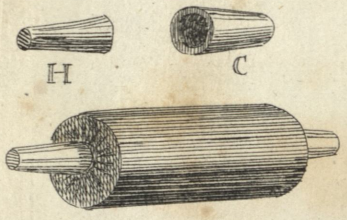

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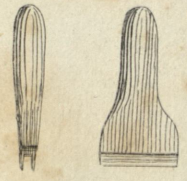

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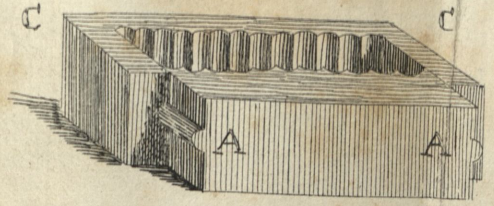

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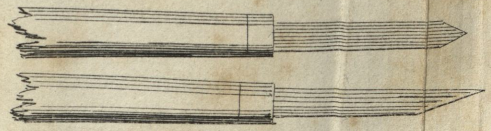

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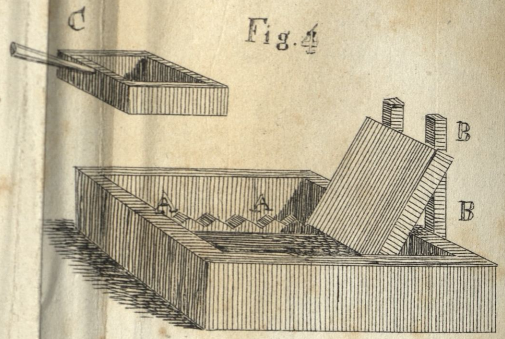

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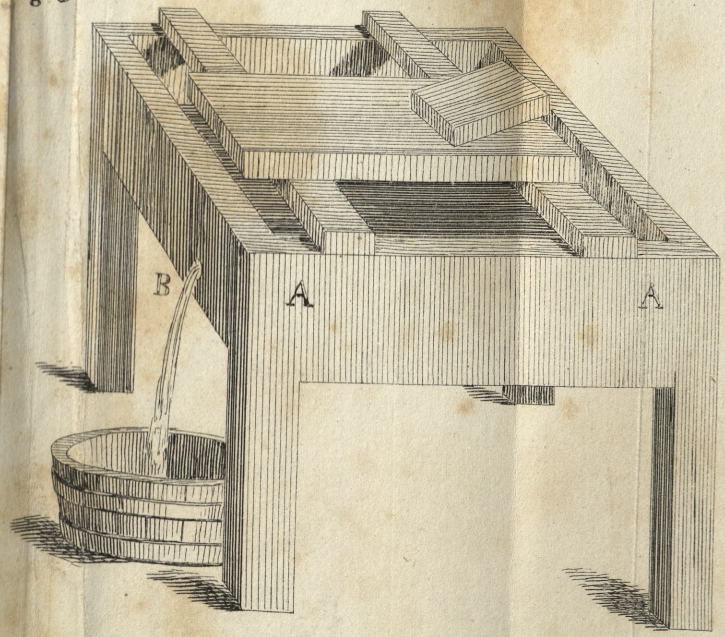

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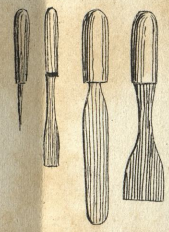

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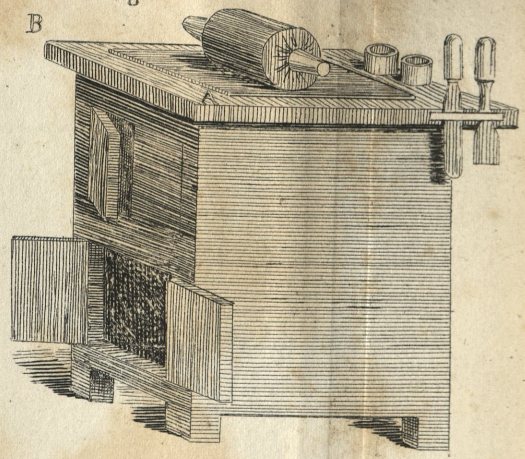

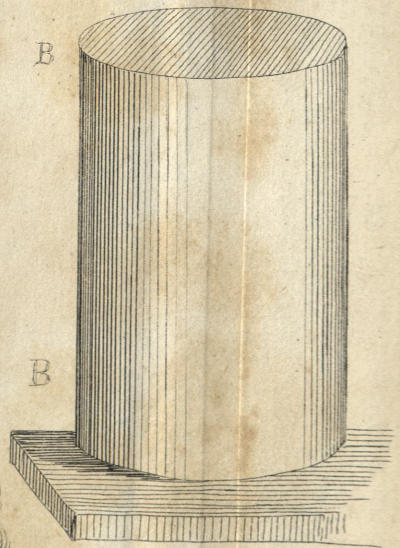

Fig. 12.

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MEMOIR ON LITHOGRAPHY.

PART I.

On the Art of Lithography.

(1.) LITHOGRAPHY is founded on mutual and chemical affinities, which hitherto had never been applied to the art of engraving. The dislike which water has for all fat bodies, and the affinity which compact calcareous stones have both for water and greasy substances, are the bases on which rests this new and highly interesting discovery.

The art of lithography may be divided into two parts: 1. The execution of the drawing; 2. The printing. The former requires but little practice, as any person who understands drawing may meet with success: the latter, which forms the chief object of this memoir, is filled with difficulties; for no lithographic printer has hitherto been found, who can be quite certain of success in printing delicate and highly finished drawings.

The first part consists in drawing on a stone, which has been previously made perfectly level and smooth, with an ink or chalk composed of greasy materials, in the same way as one would execute a drawing on paper with ink or common chalk: the second consists in taking the stone, as received from the draftsman's hands, and obtaining impressions from it, as one would from a copper-plate. To obtain these impressions, the lithographic printer wets the whole surface of the stone; but as the greasy chalk, which constitutes the drawing, has a natural aversion for water, those parts of the stone alone which are not covered with the chalk imbibe it. The printer, while the stone is still wet, passes a thick and greasy ink over its whole surface; and the greasy lines of the drawing receive the ink, while the wet surface of the stone refuses to take it: a sheet of paper is now strongly pressed on the stone, which, receiving the printing ink that has been applied to the drawing, gives a reversed fac simile of the original one: the stone is wetted afresh, afresh charged with ink, and thus a series of impressions are obtained.

In the above description consists the whole art of lithography.

The same result is obtained as in printing

from copper-plate, but by different means: the process of engraving is entirely mechanical, that of lithography entirely chemical.

In order to avoid bewildering the reader by a multitude of descriptions, we will only give those recipes, and detail those operations, which we have found by long experience to be the best. We should, however, but ill fulfil our duty, were we not to impart those hints which have often led us to very important discoveries. We shall thus make it a rule to describe every phenomenon and accident that can take place in lithography, and annex to it its explanation.

Of Lithographical Preparations.

(2.) In all great cities, a number of persons are to be met with who give the greatest care and attention to those objects which concern the fine arts.

Artists are by this means spared an immense deal of trouble and loss of time; and a painter need not be a varnish-maker or a colour-grinder. Colourmen are thus really a useful class of individuals; and it is much to be desired, when lithography will become more thoroughly known, that shops should be established, where all the

materials necessary to this new art might be found.

Those, consequently, who really wish to study lithography, must be armed with courage and patience, and prepare themselves to exercise more than one trade: it is true that black, varnish, and printing ink are to be found in shops; but none of these are proper for lithography. All the materials necessary for this art cannot be employed in the state in which they are bought, some previous manipulation being always necessary. This is a natural consequence of the mystery which has hitherto enveloped lithography, and which has until now hindered the trade from furnishing the necessary ingredients. A lithographer is thus obliged to become stonemason, carpenter, shoemaker, &c. and to prepare his own black, his varnish, and his ink; for nothing is indifferent in lithography: all must be done with care and intelligence; and often those things which, in their manipulation, appear unimportant, are in the end of the utmost consequence. We have thought it indispensable to mention this, in order to explain the necessity of entering into apparently minute details, which to a superficial observer might appear useless.

Of Lithographical Ink and Chalk.

(3.) If the only property of a lithographical drawing were to give impressions, almost every fat substance might be employed in lieu of chalk, and every greasy liquid supply the place of ink; but the chief advantage of lithography consisting in giving fac similes of drawings, it is necessary, in order to obtain them, to furnish the draftsman with ink and pencils similar to those he is in the habit of using; otherwise, by obliging him to employ materials he is a stranger to, you run the risk of cramping his genius, and it might become impossible to recognize his usual spirit and freedom of touch. It is consequently necessary that the chalk should be similar to Italian chalk, or common pencil, and that the ink should be like seppia, or Indian ink.

Amongst the fat substances we are acquainted with, wax is not sufficiently firm to make chalk; and oil cannot be employed as an ink, for it would be liable to run and spread; and, were it thickened, it would not dry, and might be rubbed out by the least accident.

Soap dissolved in water gives a slimy liquor, which cannot be employed: in short, no simple substance can answer the proposed object, and it can only be obtained by compounds.

Inks and chalks have been prepared with grease, mixed with essence of turpentine, and with resins dissolved in spirits of wine: the preference is, however, given to greasy and resinous substances, combined with alkalies. Amongst the numberless recipes we have tried for making lithographic ink, the following appears to us to be the best.

Composition of Lithographic Ink.

(4.) Tallow candle, 2 ounces.
Virgin wax, 2 ounces.
Shell-lac, 2 ounces.
Common soap, 2 ounces.
Lamp-black.

Soap is the only of the above components of which the proportion must never vary; it is destined, by the alkali which it contains, to render the other ingredients soluble in water.

Manipulation.

(5.) It is necessary, in order to mix the above ingredients, to have an iron saucepan, with a cover that closes hermetically. The wax and the tallow must be put in, and heated until they catch fire: while they are burning, the soap (which has been previously cut into small bits) must be thrown in separately, and stirred the whole

time; but a new piece must not be thrown in before the former one is melted. The whole of the soap being dissolved, the contents are allowed to burn until reduced to the volume they had before the soap was put in: great care must be taken, however, not to burn it too much. The shell-lac is now added, and the flame extinguished, if it has been possible to keep it lighted during the whole operation, as it is often necessary to extinguish it in the beginning, and take the saucepan off the fire, to hinder the contents from boiling over. The flame being once put out, if all the substances are not completely melted, they must be dissolved by simple ebullition.

A small quantity may now be put on a cold plate: if it works between the fingers like wax, it must be burnt a little more; but if, after it is quite cold, it is broken in two, and the bits will not join on being pressed with the fingers, about a dram of soap must be added to the mass in the saucepan, and, the moment it is dissolved, the flame put out.

If, when cold, a piece of this ink is dissolved with water in a saucer, by rubbing, as one would Indian ink; although at first it appears but little inclined to dissolve, it will at last unite with the water, and form a greyish and slimy liquor.

The ink brought to this state of perfection, put the saucepan upon a slow fire, and add some essence black (art. 9): it will now be observed, that the more black is put in, the more soluble in water the ink will be. Too much black, however, would spoil it; enough only is sufficient to make it black, instead of the light-brown or greyish colour which it had before the black was put in.

The ink is at length perfect; and it may either be cast in paper cylinders, similar to cartridges, or on a slab of marble (previously rubbed with soap); and, when it begins to cool, compressed by another piece of marble or stone laid over it: it is lastly cut in square bits, like Indian ink*. This composition is of the highest importance to ensure the success of drawings executed in ink. It must be similar to Indian ink, from which it differs only in weight and hardness, but of which it must

* In this and the following manipulations the progress of the flame must be observed with great care; if it weakens, the fire must be increased; but if it increases, with a crackling noise, and spreads itself to the sides of the saucepan, the latter must be instantly removed from the fire. If that is not sufficient to slacken the flame, and if the contents begin to rise, the cover must be put on, and the whole allowed to cool for some moments. Were not this precaution observed, the whole of the ink would boil over into the fire.

have the fracture, the brilliant appearance, and solubility in water. In case the manipulation has not been completely successful, the following are the means of correction:

Defects of the Ink.	*Remedies.*
The ink is not soluble.	Add soap.
It is soft, and attaches itself to the fingers.	Burn it more.
Some time after dissolving it in water, it becomes thick and slimy, and requires a continual addition of water in order to be enabled to draw with it.	This is the defect of almost all inks: it proceeds from its not being sufficiently burned. Burn it more.
The ink is not compact, and is full of bubbles.	It has been cast too hot on the marble slab: cast it again when it is less hot, and lay a heavier stone over it.
The ink has no tenacity. It seems composed of scorias.	Both these defects may proceed, either from its being too much burnt, or from its containing too much black: in either case add equal portions of wax and soap, and melt on a slow fire.

In all this manipulation, it is sufficient to have been informed of the qualities requisite to constitute good ink; and that the reader should remember, that, unless the contents of the

saucepan be burnt to a coal, the composition cannot be spoiled; and that it is sufficient to add more or less wax and soap, or burn more or less, according to the judgment of the person, and the state of the ink, to be sure of ultimate success.

Of Lithographic Chalk.

(6.) Chalk, to be of a good quality, must be firm, without being dry, and must attach itself to the stone without clogging. The cuttings of the chalk must form themselves into spirals, like wood shavings, and the texture must be close and homogeneous, like that of wax.

The composition of chalk is still more arbitrary than that of ink: more or less soap, wax, or tallow, may be added at pleasure, as more or less calcination may render these different proportions of little importance; and, as the effect of the calcination in a given time varies, according to the intensity of the flame, it is preferable to indicate, as we have done for the ink, the different defects that chalk may have, and the remedy. The reader may easily imagine that it is impossible to give certain rules for making chalk, when he is assured that it is very difficult, even with great practice, to make twice

following the same chalk: there is always some slight difference.

Chalks have been made with bitumen and mastics, but they were too friable, and did not adhere to the stone; an addition of wax was found necessary to bind the ingredients together. It must be confessed, however, that the chalk hitherto employed in lithography is far from being perfect; it generally has the defect of being too soft in summer. It is very important to keep the chalk in bottles with glass stoppers, as the least damp alters the nature of it.

Composition of Lithographic Chalk.

(7.) Common soap, 1 ounce and half.
Tallow, two ounces.
Virgin wax, two ounces and half.
Shell-lac, 1 ounce.

The manipulation of the chalk is in every respect similar to that of the ink, with the only difference that a few drams of wax (instead of the bits of soap) are thrown in, at the end of the operation. The burning must be stopped as soon as the chalk, when quite cold, breaks with a sharp and clean fracture, and resists strongly the pressure of the fingers. Less black is put in the chalk than in the ink; it is

quite sufficient that the chalk should mark easily on the stone.

If the chalk is too soft, it must be burnt again; if too brittle, a little more wax added; if filled with bubbles, it must be cast hot on a marble slab, ground with a muller, and melted again with a gentle heat; lastly it must be cast in a mould (fig. 8.) in which it must be strongly pressed: for the heat of the fire expands considerably the composition, and, were not this precaution taken, it might still be filled with pores which would destroy its compactness.

If a mould cannot be procured, the chalk may be cast in a small linen bag, previously lined with some paper, well rubbed with soap; it must then be well pressed with a weight or stone placed over it. The chalk must be taken out of the bag before it is quite cold, and cut in bits of a proper shape, either with a mould or with a knife and ruler.

Of Printing Ink.

(8.) In France the printing ink is composed of burnt oil or varnish and lamp-black; in certain cases, a twentieth part of indigo is added: in Germany, wax, grease, and tallow, are often added to the above materials.

The whole success of the printing depends

on the perfection of the ink: it is employed, as we have observed, to charge the drawing which is on the stone, in order to obtain impressions. It is necessary to remark that the lines of the drawing, thus charged, are slightly in relief on the stone; that the stones are by their nature filled with innumerable pores, and that the effect of the pression employed in printing must naturally tend to make the ink spread and penetrate into these pores.

Were this ink liquid, and were it forced by pression to spread beyond the greasy line of the drawing, and penetrate into the pores which are already occupied by water, the instant the pression ceases to exist the ink would be repulsed by the natural aversion which these two bodies have for each other; were the ink, on the contrary, thick, and composed of minute and separate particles, these might by pression and by their own elasticity remain in the pores of the stone, and adhere therein with so much strength as not to be overcome by chemical repulsion: it is this phenomenon which causes the alteration and spoiling of a drawing, and is called by the printers *running smutty*.

It would be desirable, consequently, to obtain perfect ink, to find a composition possessing sufficient consistency not to spread under the

pression, and yet liquid enough to avoid its adhering to the pores of the stone: it would be necessary that the colouring parts should be so well divided as not to clog together, and that a small quantity of ink only should produce a dark line, in order that it might lay as thin as possible on the stone. These observations naturally lead us to employ thick oils, and black composed of the finest particles.

Of the different Sorts of Black.

(9.) The above reflections, aided by long experience, induce us to reject for lithography all blacks composed of charcoals, such as blue black, ivory black, and what is commonly called Frankfort black; these materials being the produce of the calcination of bones or very coarse resinous substances. All these blacks are more or less compact, however well they may be ground with oil; and always tend to clog together and accumulate on the stone: it is impossible to employ these blacks.

Lithographic ink, to be good, must come clean off on the paper, and leave no traces behind on the stone; when this takes place, the ink with which the stone is charged again, is retained on it merely by the chemical affinity

which it has for the greasy lines of the drawing. Any other affinity but the above-mentioned one must naturally spoil the drawing, and that will happen if the ink can attach itself mechanically to the stone: it resists the attempts which the paper makes to take it up, and all harmony is destroyed in the impression; often those lines which ought to be dark on the paper, appear faint, while those which ought to be faint, print dark. All those parts on which too much ink collects, cannot withstand the pressure, without spreading and gradually increasing in breadth until they unite and clog together; thirty such impressions would be sufficient to destroy the drawing completely.

The only black that can be employed in lithography is lamp black; it is the produce of the smoke proceeding from the combustion of select resinous substances: it must be soft to the touch, woolly in its appearance, infinitely lighter than any other black, and mix freely with oil.

Having found that by burning select resinous substances we could obtain a perfect black, far superior to what is sold in shops, we have invented a cheap and simple apparatus, by which a black may be collected from essence or spirits of turpentine, which is far preferable to any other; we will call it essence black.

This black is indispensable to make good lithographic ink and chalk; but as it is much dearer than lamp black, we are obliged, unfortunately, to employ it only in select cases; were it not for this circumstance, we should always give it a decided preference.

Lamp-black, proceeding from lamps, might be an excellent substitute, but it is difficult to be procured.

Apparatus for making Essence-Black.

Fig. 12.

(10.) This apparatus is composed of a small earthen or iron pan (A) filled with essence or spirits of turpentine; an iron plate, with a hole in the centre for a wick, must serve as a cover to the pan; a paper cylinder (BB), shaped like a drum, and closed at the top, must be placed over the lamp; this cylinder shutting out all communication with external air, the smoke arising from the lamp attaches itself to the inside. In order to collect the black which is formed, it is sufficient to strike gently on the cylinder with a small stick: when a sufficient quantity is produced, the cylinder may be taken off and the black laid by.

The apparatus we have just described is very

convenient for persons in the country who cannot procure good black.

Calcination of the Black before it is employed.

(11.) A clean iron kettle must be procured with a cover that closes well; the lamp-black, or the essence-black, must be put in the kettle and the cover put upon it; it must now be placed on a good fire until the whole is red-hot, and no more smoke escapes from the black.

This operation is highly necessary to disengage from the black those greasy and drying substances which it contains, and which might attach themselves to the stone: the black also, before this operation, has a brown and sooty colour; it is by these means obtained of a fine black hue; if it were wanted extremely fine, it might be sifted in a silk sieve.

Indigo Blue.

(12.) This blue is always clear. To obtain it fine it must be first pounded, mixed up to a paste with water added in small quantities, and well ground on a stone with a muller; the whole is now thrown in a large pan filled with water; it must be well stirred and instantly decanted in

another pan, taking great care not to throw the sediment of the first pan into the second. The contents of the second pan are now allowed to settle, when the colouring matter will separate from the water and precipitate itself to the bottom; the water must be poured off with care, and the sediment dried, by which means an impalpable blue powder will be procured, which is indispensable, in certain cases, to obtain a very dark printing ink in order to imitate line engraving.

Oils employed in Lithography.

(13.) No oil can be employed in lithography in its natural state; for, before the printer charges the stone with ink he must damp its surface, but the water soon evaporates, and the oil would quickly spread and spoil the drawing, however well it might be mixed with the black. The oil must consequently be rendered thicker; that object is obtained by burning it until it acquires sufficient viscosity to preclude all fear of its soiling the stone, even when unmixed with black.

It is not always necessary, however, that it should be equally thick; this obliges printers to have by them oils of different strengths.

Linseed and walnut-oil are the best for the purposes of lithography, but they must be of a superior quality. Oils a year old are far preferable to those which are fresh made.

Burnt oil, under the name of varnish, is to be procured in shops: it is oil burnt with litharge, which gives it a drying quality, so that it is apt to stick to the stone, and dry the drawing.

The varnish, of which we are going to describe the preparation, differs from the former, in its containing no litharge, and being less greasy: too much care cannot be taken in its preparation. The quality of the varnish and the black are most important to ensure success.

Manipulation of the Varnish.

(14.) Put one or two quarts of linseed oil in a kettle large enough to contain four: the oil must be heated until it catches fire (it is safer to light it with a piece of paper, or by warming some of the oil in an iron ladle until it flares, and bringing the oil thus lighted to the contents of the kettle): if the flame crackles and spreads to the sides of the kettle, it must immediately be taken off the fire, and the cover

(which must be made to fit well) put on; otherwise the oil would boil over, and cause very serious accidents.

If the oil burns with difficulty, it must not be taken off the fire until it appears to flare freely: the flame may easily be kept up by stirring it with an iron ladle, and the cover put on as soon as the flame grows fierce. It is now better to allow it to cool a few seconds, and light it again, which may be done with a piece of paper.

The oil having now lost a sixth of its volume, two thick slices of bread must be employed to imbibe its greasy particles. The first slice must be put in with a fork, and stirred about until it is fried; but the oil must burn freely before the second slice is put in: it is even better to put it on the fire again if the flame is too dull.

The oil is now freed from grease, and it is necessary to pour out a drop in a cold plate; and, if sufficiently burnt, it must be of a sirupy nature. A quarter of the contents of the kettle must be laid apart: this forms the varnish No. 1. The remnant must be again burnt for a few minutes, and another quarter taken out: this forms the varnish No. 2. The same process is continued with the other remaining two

quarters, which will give the varnishes Nos. 3 and 4. This last must be thick and ropy.

It will be seen hereafter that these different qualities of varnish are indispensable in the course of printing.

If it were desirable to render the ink shining, a little sugar-candy, or any mucous substance, put in the oil while it is burning, would fulfil the object.

This varnish must be kept in small earthen jars, well closed *.

Mode of mixing the Varnish and the Black.

(15.) Take as much of the varnishes Nos. 1 and 2 as can be contained in half an egg-shell, mix them on the grinding-stone with an equal quantity of black. It must now be worked some minutes with the muller: then add some more black, and grind it again; and go on adding black

* Those who are desirous of preparing their own varnish cannot be sufficiently cautioned against the dangers of the operation. It ought never to be made in a floored room; and, if possible, an out-building ought to be selected, as even two quarts of oil will sometimes (if the flame cannot be mastered) flare up to the height of fourteen feet, and spread itself in all directions: at any rate a couple of wet sacks ought to be kept ready, in case of accident, as that alone can put out the flame. *Translator's note.*

and grinding, until the ink becomes extremely thick, and refuses to unite itself with any more black.

This operation requires great strength; and the ink is never good if not perfectly well mixed.

At first the ink is spread over the surface of the colour-stone, working the muller over the whole, and taking it up with the colour-knife, and again spreading it with the muller. In the beginning of the operation, the ink being thin, this is easily performed; but by degrees the ink becoming stiffer, by the addition of black, the muller can no longer work it, when laid flat: in which case it is necessary to grind it with the side or angle of the muller, and thus form lines in all directions on the surface of the stone. This is the time for well working the ink: it must be repeatedly taken up with the knife, and again spread with the muller, until the whole appears shining and well united: if any dull specks are seen, it is not sufficiently mixed. The whole operation takes up at least two hours to be well performed.

This ink must be preserved in small lumps, in water: it is destined for drawings executed with lithographic ink, and now and then to be used, according to circumstances, with the var-

nishes Nos. 3 and 4: it must never be used but three or four days after it is made.

The printing ink for chalk drawings must be made with the varnish No. 3, mixed with lamp-black: some may be made also with the varnish No. 4. Three quarters of an hour are quite sufficient to grind this ink; and it may immediately be used for printing. It need not be made so thick as the first ink; and, as soon as the muller can no longer be worked flat, no more black is to be added.*

Prussian blue must be ground with great care with the varnish No. 1, and prepared rather thicker than for oil-painting: it is kept in a bladder, like oil-colour, and must be used only a week after it is made.

Ink for preserving Drawings upon Stone.

(16.) The drawing on a stone is always charged with printing ink if the printing is stopped, were it even for a minute. The printing ink is less liable to dry than the drawing itself, but it does dry after a short space of time; and, unless impressions are taken once every

* If shining ink is wanted, a little isinglass, dissolved in spirits of wine, may be added.

ten or twelve days, the lines no longer receive the ink, and the drawing is lost.

When several hundreds of stones are employed (as is often the case in lithographic establishments), one may easily imagine the immense loss of time which the necessity of freshening the ink must cause: and, on the other hand, that the least negligence must occasion a severe loss.

It has often been with us a matter of surprise, that no printing ink should hitherto have been composed in which wax and soap were the principal ingredients. It was easy to suppose, from the nature of these substances, that lines charged with such an ink would never dry; and indeed experience soon confirmed our supposition. We consequently are persuaded that we are rendering a real service to lithography, by giving the following composition:

Tallow,	1 ounce,
Soap,	3 ounces,
Virgin wax,	4 ounces.

Melt the tallow and wax together, until they catch fire; throw in the soap bit by bit; put out the flame as soon as the composition has acquired the consistency of wax; add merely black enough to give it a colour; and cast the whole on a marble slab. (See Art. 5.)

When wanted, this ink must be gently melted on the fire, with the addition of a fifth or a sixth of the varnish No. 3; and, when cold, it must have the consistency of the printing ink mentioned in Art. 15. It must be ground before it is applied to the drawing; and, when properly prepared, the stone will always be fit for printing, however long it may have been laid by.

Mixture for cleaning Stones when they run smutty.

(17.) Put in a glass phial equal parts of water, spirits of turpentine, and oil of olives; shake the mixture well, until it froths; throw this froth on the stone which you want to clean (having previously wetted it), and rub it gently with a soft spunge; the printing ink which had collected on the stone will immediately dissolve; the whole surface will become white, without any appearance of the drawing; but, on charging it again with printing ink, the drawing will soon re-appear, as sharp and as perfect as when it was first executed.

Let us now examine what has taken place. The lines of the drawing became smutty (that is to say, that they retained too much printing ink), not only on account of the chemical affinity

which the stone has for the ink, but also by a mechanical cause (Art. 8); and the printing ink having accumulated on the stone, the lines had naturally spread and joined by the pressure. Now, the water contained in the mixture keeps damp those parts of the stone which ought to be so, the spirits of turpentine dissolves the printing ink, while the olive oil, by its fatness, preserves the lines of the drawing. If the stone, when it first began to run smutty, has remained wet under the accumulation of ink, the latter, although it may have spread beyond the lines of the drawing, will not have communicated its grease to the stone, in which case the mixture will restore it to its primitive state; but if the stone has got dry under the smutty parts, these will have imparted their grease, and the mixture will no longer have the desired effect, in which case no means are left to save the drawing.

Good lithographic printers have rarely occasion to employ this mixture; but it is highly useful to beginners. We will shortly point out the means of avoiding the necessity of employing it.

Transfer Paper.

(18.) The necessity of reversing both writings and drawings on the stone, has made the use of this paper indispensable to all those who are not in the habit of writing reversed.

This paper must unite two qualities: first, it must be as good to write upon as common paper: secondly, the writing must leave no traces behind on the paper, when transferred to the stone.

Mucous substances, with which the paper is besmeared, are hitherto those which have been found to answer best the purpose. It is sufficient to wet the paper thus prepared, to make the ink separate from it.

Gum, starch, glue, isinglass, &c., may be made use of.

Whichever of these substances is selected, it must be dissolved on the fire till, when cold, it acquires the consistency of starch; it must be applied lukewarm, on one side only of a sheet of soft sized paper.

The following composition (which is to be prepared as has just been explained) is found to answer the purpose.

Glue,	6 drams,
Gambooge,	1 dram.
Alum,	½ dram.

German Composition.

Starch,	2 ounces.
Plaster of Paris proceeding from old busts pounded and sifted,	4 ounces.
Gambooge,	½ dram.

These substances must be well ground on a stone until reduced to a fine paste; it must then be dissolved in two or three glasses of water, put on the fire and boiled until when cold it acquires the consistency of jelly; this must be applied lukewarm, on one side only of a sheet of soft-sized paper; several coatings must be laid on, allowing them to dry each time; when the paper is perfectly dry, it must be passed in the press on a polished stone, in order to make it smooth.

Before you write on this paper it is necessary to rub a little powdered gum-sandarac over the preparation, in order to hinder the ink from spreading.

Transfer Ink.

(19.) The composition of this ink is the same as that mentioned in art. 4. The manipulation is the same, but it must be less burnt and less es-

sence black put to it; in short, it must have the consistency of wax. When in this state, it must be slowly melted, and one dram of wax to every ounce, and two spoonfuls of the varnish No. 4., (art. 13.) added to the whole. It must then be cast in sticks similar to Indian ink, (art. 5.).

Of Lithographic Stones.

(20.) Any stone which effervesces with an acid, which imbibes water with facility, and is easily penetrated by greasy substances, is fit for lithography. It is well known that carbonate of lime fulfils these conditions; next to silex, lime is the earth, found in greatest abundance on the surface of our globe, and chiefly in the state of carbonate. It is found, first, in masses in primitive beds, and almost always of a white colour, and in a pure state; secondly, in transition beds, in masses of different colours, proceeding from the detritus of the first, such are marbles; thirdly, in beds of later formation: in these it is found in abundant strata; but it is necessary to choose amongst these, as these beds or deposits formed by water are almost always of a coarse texture, intermixed with crystals or filled with shells.

By this it is easy to see that lithographic

stones are not scarce; from the coarse calcareous stone which serves for buildings, to the compact calcareous ones, which receive the polish of marble; an infinite variety of other stones exist, which contain with lime, silex and alumina, and the two latter even to excess, and which are all more or less proper for lithography.

Lithographic stones may consequently be found in chains of mountains, on hills and in plains; those therefore, who are in search of them, ought to be provided with a small bottle of nitric acid, and whenever a white stone is found which does not strike fire with steel*, it must be tried with the acid, and if an effervescence takes place, it is a lithographic stone. The following are the rules by which the best may be selected.

The best lithographic stone hitherto found, breaks with a conchoidal fracture; it is of a fine homogenous texture, its colour is of a uniform and yellowish white, being nearly similar in appearance to the hone stones used in sharpening razors; on breathing on them, a slight aluminous smell (similar to that of pipe-clay) is perceived.

The quarry from which the first lithographic

* It is very rare to find calcareous stones which strike fire with steel.

stones were extracted, nineteen years ago, is still that which furnishes them in the greatest abundance, and of the largest dimensions. It is situated at Solenhofen, near Papenheim, in Bavaria. No quarries hitherto known in France give stones equal to the German ones.

Stones however have been found near Chateauroux, which in some respects have a great advantage over the Bavarian ones; they are much harder, of a finer texture, they preserve much better the soft tints in chalk drawings, and the impressions are much brighter. For these reasons, the French stones would be far superior to the German, were they not interspersed with innumerable spots and defects, so that it is extremely difficult to find one, eighteen inches square, which is free from them.

We have tried some stones extracted from a new quarry, found near Chatellerault; they appear to possess all the necessary qualities: they may be procured of any size; they are white, slightly inclined to a grey, excessively hard, and highly aluminous; they absorb both water and grease with equal avidity. Lines drawn upon this stone print with great purity, and it is perhaps preferable to any other for ink drawings.

Next to these stones, which are the only ones

to be employed for highly finished drawings, we may rank white marbles, which are not so proper for lithography; after these come the common calcareous stone, which produce drawings of various qualities according to the more or less fineness of their texture; and last of all, the coarsest calcareous stones, which from the number of foreign substances they contain, cannot be employed in lithography.

Some lithographers have attempted to substitute stuccos and compositions to stone; the newspapers have announced that prepared pasteboard was employed in Prussia; we have often thought that vellums, linen, or even paper, might be prepared so as to be employed instead of stone, and indeed this discovery would double the utility of lithography.

Of sawing and polishing the Stones.

(21.) In order to withstand the necessary pressure, a stone a foot square must not be less than one inch and a quarter in thickness; and one three feet square, must be at least two inches thick.

When the stones are a great deal thicker than is necessary, they may be divided by a saw and sand, as is done with marble; and after they have been squared, they must be rubbed face to face

with sand and water, and the edges rounded with a file and smoothed with pumice stone.

If there are any defects in the stone, they are sometimes rubbed down with sand and water; but this operation is often very long and tedious: some machinery might easily be invented to supply the labour of men, which would be a great saving of time and expense.

Preparations of the Stone for Chalk Drawings.

(*22.*) The stone being now perfectly smooth and level, it must be well washed in order to free it from any coarse grains of sand which might adhere, as one alone of these is sufficient to fill the stone with innumerable scratches; it is placed on a table (Fig. 3.), and a small quantity of water and very fine sand strewed over its surface; another stone is then placed over it, and they are rubbed face to face, adding now and then fresh sand and water: this operation must be performed with great care, and small circles must be described in rubbing them together: in a short time the grain will become very fine, and when sufficiently so, they must be well washed and wiped with a clean cloth. In this state they are ready for the draftsman.

It* is sufficient to inform the reader that whether the stones be rubbed with sand and water, or with sand alone, the operation is only terminated when, on being perfectly cleaned, they appear uniformly white, of an even grain, and without any shining part; in short, their appearance must be exactly similar to that of a sheet of vellum paper. The grain may be made finer or coarser according to the fineness of the sieves that have been employed in sifting the sands.

Those stones which have been grained with dry sand must be wiped with a dry cloth; but this must be done with great care, as if any portion of dust remains, the chalk, in making the drawing, cannot penetrate to the stone, and consequently these lines are liable to disappear in the printing.

Different grains are given, according to the nature of the drawings: fine and delicate drawings require a very fine grain, while bold and spirited ones require a coarser one; this leads us to remark, that lithographic drawings gene-

* In England the sand called Silver Sand, for preparing the stone, and the common brown sand (which is strewed on kitchen floors) for giving it a fine grain, are the best. It may also be observed that the upper stone is always finer grained than the under one.—*Translator's note.*

rally fail in point of effect, and we are of opinion that this is chiefly occasioned by the uniformity of the grain which is given to the stone. In fact, when an engraver wishes to observe the rules of aerial perspective in an engraving intended to imitate chalk drawings, he will take care to execute all the distances with fine and delicate strokes, composed of very fine dots ; while the fore grounds will be done with large strokes composed of large dots. By this we see that it is not the breadth and strength alone of the strokes which give keeping to the engraving, but that this depends a great deal on the size of the dots which compose the lines. How then can it be expected to produce the same effect on a stone of which the grain is uniformly the same? It may perhaps be alleged that the finest drawings, in point of effect, are produced on paper, of which the grain is the same throughout its whole surface : yet we must observe, that the drawing would gain a great deal were it otherwise, and that it is impossible to do upon stone, with lithographic chalk, which either bends or breaks, according to the state of the temperature, that which can be done upon paper with good pencils of different degrees of hardness. Were it even possible to finish

highly upon the stone, it must be remembered that a great part of this high finish disappears when printed; that the more delicate the touches the more the failure of these parts offend the eye, so that those portions of the drawing which ought to be the finest, are often those which have the coarsest grain, as is continually the case in lithographic prints. In fact, in order to insure success in the printing of a drawing, the chalk ought to touch nothing but the extremities of the grain of the stone; all the touches would then be in the most favourable situation to hinder them from running smutty. Now if, by dint of patience and high finish, the interstices which separate the grain of the stone are filled with chalk, either this chalk does not hold during the printing, or if it does, it will of course receive the printing ink; but it is evident that the paper cannot be applied with so much strength to the hollow parts as to those which are in relief, consequently the paper will take up but a part of it: at the second proof, a new quantity of ink is added to the first, and this will thus go on increasing until the whole of the cavities are filled with ink, and those parts of the drawing appear but one mass of black.

From the above observations, we are firmly

persuaded that an equal grain is extremely unfavourable to aerial perspective; and that those who wish to obtain effect and good impressions, must give different grains to different parts of the stone, according to the nature of the drawing.

Method of rubbing off Chalk Drawings.

(23.) When a stone is done with, and it is wished to rub off the drawing which is on it, in order to execute another, it must be first rubbed with sand until the lines of the drawing have disappeared; it must then be washed with a mixture of aqua fortis and water, (in the proportion of one part of acid to twenty of water.) This operation is indispensable in order to destroy the former drawing, which otherwise would reappear in the printing: it is then rubbed with fine sand, and treated in every respect as in article 22.

Preparation of Stones for Ink Drawings.

(24.) The stones having been prepared with fine sand, as is done for a chalk drawing, must be well washed, and carried to a table perfectly free from sand or dust; they must then be

rubbed face to face with powdered pumice stone and water; when perfectly smooth, they must be again washed. This being done, take a large pumice stone, of a fine texture, and rub each stone separately with it, and with a circular motion; this must be continued until the stone is polished and perfectly free from grain or scratches.

When it is wished to give a still higher polish, the stones are often rubbed with a rag and pumice stone well pounded and sifted; it must be afterwards washed and rubbed violently with a linen rag; the stone is then ready for the draftsman.

Method of rubbing off Ink Drawings.

(25.) In order to rub off ink drawings, the surface of the stone must be strewed with powdered pumice stone and water, another stone laid over it, and thus they must be rubbed face to face until the drawing disappears: acid and water are now to be poured on the stone, which must be afterwards washed and prepared afresh as in article 23.

Solution for the Preservation of the Stones.

(26.) Take some gum arabic and melt it in rain water until well dissolved ; add water until it has the consistency of oil in summer : it must be strained before it is used.

This solution is of the utmost importance in lithography ; it must be preserved in a bottle, and if kept a long time, a few drops of spirits of wine may be added. When one leaves off printing from a stone, it must be covered with a thin coating of this gum, laid on with a flat brush, in the same way that a picture is varnished. The gum penetrates all the wet parts of the stone, and when dry, fills all its pores ; it surrounds the greasy lines of the drawing, hinders them from spreading, and preserves them in all their purity ; and if by some accident the drawing were rubbed, it is sufficient to wash it to restore it to its former state.

The coating of gum must not be laid on too thick, for in summer it might be liable to crack and scale off ; this accident may be avoided by keeping the stones in a damp place, by laying on the gum thin, or by adding a third part of sugar candy to the solution.

It is said that in Germany stones are often preserved with onion juice with the addition of a little brandy.

Of the Papers employed in Lithography.

(27.) Vellum paper is the best for lithography; and, if possible, for chalk drawings it must be thick, of a fine texture, and sized: soft paper is apt to stick to the stone and tear off.

Thin vellum paper is better for ink drawings.

Preparation of the Paper.

(28.) The paper having been previously cut of the necessary size, is placed in a heap to the right: two sheets are taken with the left hand, and the upper sheet wetted with a sponge with the right hand; the sheets are thus taken two by two, until the whole is wetted: the paper must be placed between two boards to free it from any excess of water; half an hour afterwards the upper board must be loaded with a weight of seventy or eighty pounds, and left in this state five or six hours. Two sheets must now be taken at a time, turned on every side and strongly struck with the flat of the hand;

it must then be placed again between the boards for use; this operation is very necessary, in order to spread the paper and make it equally damp.

Common paper may be wetted with less care: take five or six sheets at a time, dip them in a tub of water and drain them, and so on till the whole is wetted; it must then be pressed and struck with the hand as above.

Wetting paper is an operation which requires great practice; if it is too dry it does not adhere well to the stone, if too wet it does not take up the printing ink. In general paper is less wetted for lithography than for copper-plate or common printing; it is sufficiently damp if it does not make a noise when bent.

We have now communicated all that we know of lithographic preparations, and have tried, as much as possible, to simplify the various compositions; we have obtained, with the recipes we have given, impressions which equal the finest that have been produced in lithography, although it is very possible that other persons might be equally successful, even if they employ totally different compositions. This will not excite any surprise, when it is considered that lithography is entirely founded on the laws of chemistry, and that the number

and nature of substances are so great and various, that their combinations have no bounds. If we reflect on the little that has hitherto been done, and on all what remains yet to be discovered, it will be evident that this new art is still in its infancy, and that it is impossible to know what degree of perfection it may attain.

Although this work will enable any person to make perfect imitations of drawings and etchings, yet we are far from believing that it is a perfect treatise of the whole process of lithography; and though we think ourselves acquainted with every thing that has hitherto been discovered, we are persuaded that this memoir will be found very incomplete twenty years hence, and leave to those who unite knowledge to talent the task of improving on Sennefelder's admirable discovery.

MEMOIR ON LITHOGRAPHY.

PART II.

OF THE NECESSARY UTENSILS.

LITHOGRAPHIC PRESSES.

Cylinder Press.

Plate 2.

(29.) This press consists in a strong frame or box (fig. 13, 14, 15,) AB, having an upper part or cover CC, in which a smooth calf-skin is strongly stretched, by means of screws with nuts, fixed in the cross-bar XX, and which catch a small iron bar screwed on the skin; the other extremity of the skin being screwed on the opposite cross-bar of the frame CC. This frame is fixed on the under one AB, by two hinges TT, (fig. 17) so constructed that, by means of thumb-screws, the upper frame CC may be screwed higher or lower according to the thickness of the stones. The box AB must be about one inch deep, and have a very strong and level bottom.

Three or four sheets of thick pasteboard must be put in this part of the box, to place the stone upon. When open, the part CC rests on the moveable frame R.

This box, AB, moves backwards and forwards (by means of the star-wheel M, and the pully and strap N, Q) in two grooves formed in the side-pieces DD; these grooves must have holes and two pins, which serve to stop the box at different distances, according to the size of the stones. The box AB is brought back by the strap V and the weight Y.

The two uprights EE have a groove in their length, see section fig. 18, in which the piece G works up and down. On this piece G is screwed the strong iron hook F, fig. 17, which moves on a hinge at W; opposite are the two uprights PP, having three holes a a a, by which means the scraper bearer OO may be brought higher or lower, by means of an iron pin on which OO turns. This part must be so constructed that the scraper bearer might be put in an upright position, and out of the way of the printer, while he is charging the stone. The scraper is a flat piece of beech or box-wood, fig. 19. shaped like a wedge, where it touches the leather, and about an eighth of an inch in that part; it must be planed quite level so as to fit the stone

exactly. Each scraper must have a hole in the middle, that it might work about in the scraper bearer: this is very necessary, as often both surfaces of the stone are not parallel. The upper part CC being shut, the scraper-bearer is brought down, and the iron hook F having caught the part Z of OO, the whole is pressed down by bearing with the foot on the treadle I. This treadle moves on a hinge screwed on the floor at A; at B is fixed a long iron plate, K, pierced with several holes, so that by means of a pin the bar HH may be brought higher or lower; (by this means the pressure on the stone is diminished or increased). A rope L, fixed on HH, and working through the side-piece DD on a pulley, draws up HH by means of the weight c′, when the foot is taken off the treadle I.

The box AB works on a cylinder R′R′, made of hard oak, at least seven inches in diameter, and turned very true; it must be placed exactly under the scraper, and turns on two iron pins working in brass sockets.

(30.) The table, fig. 1, is placed near the press at U. A bason containing rain water and a sponge must be placed on a projecting board E′E′, fig. 13, and the printer taking a little water with the fingers of his left hand, splashes it on the stone and spreads it with a sponge; he then

works the roller on the stone fig. 1, and charges the drawing with it. The paper being placed, the part CC is shut down, the scraper-bearer is brought down, the hook F placed so as to catch the part Z of OO, and HH being regulated by means of the plate K, according to the thickness of the stone, the printer bears down the treadle: he now seizes the wheel M, and by turning it, the strap Q draws the box AB under the scraper. The impression is now taken, he raises his foot from the treadle, loosens the hook F, throws up the scraper-bearer OO, and the weight Y draws back the box AB in its former position.

Fig. 20.

(31.) *Lever Press.*

This press is very good for small stones and printing writing, as it works more expeditiously than the cylinder press. The stone is placed on a table AB. The frame CC is similar to the frame CC of the cylinder press: DD is an upright fixed on the floor and against the ceiling; the longer it is, the truer the scraper works on the stone: EE works in DD by means of a pin F, and GG has several holes at H, so that by means of a pin the degree of pressure may be regulated. By bearing on the treadle I I, the scraper is

strongly pressed on the stone, and worked with the hand by pulling it backwards and forwards. The pole of the scraper is composed of two parts, the upper piece and a lower one, L, fig. 21, on which the scraper is screwed, and moving in the upper piece which is so made that when the printer draws the scraper to him, the whole forms one straight line, and when he pushes it back, the piece L bends or folds at J.

In both presses the leather must be well greased on the outside, to enable the scraper to slide with ease.

The stones must be well fixed with wedges, and the greatest care taken, in case a cylinder press is employed, to regulate the box by means of the pins and holes of the grooves that are formed in the side-pieces. These must be so placed that the scraper should begin and finish acting on the leather within half an inch of the sides of the stone: tearing the leather is the usual consequence of neglect in this respect.

Plate 1. Fig. 1.

Table for making the Printing-Ink.

(32.) This table has a marble slab (AB) at the top for working the roller, which is to impart the printing-ink to the stone; near it are placed the

pots containing the different printing-inks; underneath are two small cupboards; in the upper one are kept the oils, inks, gum, &c.; in the under one the rollers, in order to keep them free from dust.

Fig. 2.

(33.) 1. Tool for taking up the ink when spread on the stone.

2. Pallet-knife for the same purpose.

3. and 4. Printers' tools for correcting the stones.

Fig. 3.

(34.) The table for rubbing down the stones. This table is open at the top, and has two cross-bars (AA) to lay the stones on. The bottom of the table slopes towards the hole (B) in order to let the sand and water run out in a pail placed underneath for that purpose; the sand which falls in this pail may be dried, and when sifted, serve for fine graining the stones.

Fig. 4.

(35.) Etching-box. This box may be made of any size; it must be water-tight, and have two pieces of wood (AA) with notches fixed in its bottom. The stone, when it is etched, must rest on the notches and the pieces of wood (BB): (C) is a long and narrow trough, with which the acid is thrown on the stone.

Fig. 5.

(36.) Roller for charging the drawings with printing-ink. These rollers may be made of any length, but must not be less than four inches in diameter. They are made of alder or lime-tree; the wooden handles which project serve for the printer to hold them by; the rollers must be turned with great care, and covered with at least three complete turns of flannel, well stretched and nailed at the extremity of the rollers, near the handles: the whole is covered with a calf's-skin, sewed with great care, and so as to fit tightly. This operation is performed as follows: the calf's-skin is wetted, stretched on a board with nails, and allowed to dry; it is then cut so as to fit the roller well; the seam must be sewed with silk, and with what shoemakers call a closing-stitch; this must not be performed on the roller, but separately, and with the smooth side outwards; when the seam is finished the skin must be turned with the rough side outwards, and is then slipped on the roller like a glove: the extremities (the skin being cut longer than the roller) must be tied together with a string.

As in turning the rollers on the stone the handles might hurt the printer's hands, two little handles (H) are employed, and so made that on

their being pushed more or less on the wooden handles, they work more or less easily; this effect may also be greatly helped by the pressure of the hands.

This mode of holding the rollers is a most important thing in lithography, and a lithographic printer ought to study it with the greatest care: if he perfectly understands how to manage the roller, he may either force the stone to receive more ink or take it up from the stone; in short, he may vary as he likes the effect of the prints, and even change the entire tint of the impressions.

As the stones for ink drawings are polished, it is not so easy to make the rollers turn on them; in which case wooden handles (c) are substituted for the leather ones.

In passing the roller, which is besmeared with printing ink, over the stone, those parts which have been previously wetted will of course refuse to receive it, while, on the contrary, the greasy lines will attract it, according to the intensity with which they are drawn, and the difference which exists between the several tints will depend entirely on the varied effects of the drawing, and on the manner in which the printer will press with his roller.

In order to prepare a roller for receiving the

printing ink, it must be held near the fire and well besmeared with lard, which must afterwards be scraped off; it must then be worked for two or three days on the table (fig. 1), with the varnish No. 4, after which it must be covered with printing ink, and is then fit for use.

If a roller is to be laid by for more than a fortnight, the ink must be with care scraped off, and it must be besmeared with hog's lard.

Fig. 6.

(37.) A brass roller, two inches and three quarters in diameter, covered with a piece of woollen cloth; this roller serves to make certain transfers on the stone.

Fig. 7.

(38.) Tool for cutting the chalk of a square shape: the chalk having been cast in a bag, (as mentioned in art. 7), it is cut by this tool with a stroke of a mallet.

Fig. 8.

(39.) Mould for chalk. This mould consists of two brass plates, with semicircular grooves or flutings so constructed, that when closed (which is done by pushing the box (A) in the box (C), these plates form a hollow cylinder: the box

may be made four inches and three quarters in height (by which means each groove will be of the length of two pencils), and each groove two eighths in diameter.

Before the chalk is cast in this mould, care must be taken not to close it completely; and when it begins to cool the mould must be screwed tight in a press: this pressure will squeeze out some of the chalk at the upper part, and it must be cut off with a knife: when the chalk is quite cold, on opening the mould it will be found shaped in small compact cylinders, which must be cut in two.

Fig. 9.

(40.) Quills and pens are very soon blunted by the nature of the stone and of the ink; steel pens are the only ones that can be used. These are made out of a very thin piece of steel, which must be bent in the form of half a cylinder; it must be cut of the shape indicated in fig. 9, with a pair of sharp scissors, tempered, and then ground to a fine point on a hone: these pens are fixed on a common quill.

Fig. 10.

(41.) A steel pen with a screw for drawing

straight lines: this is an indispensable instrument for drawing lines: the parts (B B) must be much more bent than in those usually found at instrument makers: this is done in order to enable the ink to flow freely to the point, which otherwise it would not do. As the points of this instrument soon get blunt by use, the moment it is the case, they must be ground with great care on a hone with oil. This is a very delicate operation, as the fineness of the lines depends entirely on the points being perfectly sharp and even.

(42.) A miniature hair pencil is also an indispensable article; two thirds of the hairs must be cut off with a sharp penknife, so that only twelve or fourteen hairs remain. A hair pencil thus prepared, and the steel pen (article 41) are the only instruments with which drawings can be executed that can equal engravings in the delicacy of the lines.

Fig. 11.

(43.) The common scrapers for scratching out writing are not convenient for lithography; it is better to take pieces of square steel, shaped as represented in fig. 11, ground on a stone, and fixed in handles.

Fig. 12.

(44.) Apparatus for making essence black. See article 10.

Note. The figures 9, 10, and 11, are as large as nature.

MEMOIR ON LITHOGRAPHY.

PART III.

Precautions to be taken for Drawing upon Stone.

(45.) The stone must be well wiped with a clean piece of linen ; this is a very necessary precaution, as some dust or sand might still adhere to the stone, in which case the drawing would disappear in those parts.

The draftsman must take great care that no greasy substances be allowed to come in contact with the stone, as these would infallibly mark in the printing ; he must on no account touch the surface with his fingers, nor breathe upon it. He must also be cautious lest any spittle should fall on the drawing, and it is necessary to lay a sheet of paper under the hand to avoid any accident.

(46.) The sketch may be made with lead pencil or black chalk, observing that the impression

will be the reverse of the drawing. One may also, to avoid doing the drawing reversed, make a sketch on paper with a soft pencil, put it on the stone with the drawing towards it, and pass it in the press; by this operation the sketch will be found traced on the stone.

If one wished to have the sketch on the side according to which it is drawn, the paper must be rubbed behind with red chalk or black lead, and applied to the stone; by passing a blunt needle over all the lines of the drawing, the black lead which is on the other side will repeat them all on the stone: to avoid dirtying the back part of every sheet of paper, a separate sheet, rubbed with black lead, may be laid between the drawing and the stone.

It is necessary to have several portcrayons ready with chalk in them, as, from the nature of the chalk, it is apt to get heated and softened by the warmth of the hands.

(47.) In speaking of lithography, persons often assert that drawing upon stone requires no previous study. We think it necessary to inform artists that, if they wish to be fully successful, this new art requires their serious attention. The assertion may be true with regard to a slight sketch; but it is far from being so

for a finished drawing, particularly when one considers that it frequently happens that two drawings, finished with equal care, and executed with the same chalk and ink, succeed very differently in the printing. Another circumstance which must be considered is, that of two drawings, the one executed in a firm and free manner, the other highly finished, it almost always happens that the former succeeds, while the other often fails in the half tints: this proves evidently that there exists some secret cause, which proceeds from the method of drawing of the artist, and that lithographic chalk adheres to the stone more or less, according to the mode in which it is applied to it. This phenomenon deserves investigation, and we will observe, First, that lithographic chalk is by its texture firm and solid, so that when two portions of it are separated from each other and again brought into contact, they will never adhere so strongly as before (article 6); secondly, that the greater the power employed to make chalk adhere to a substance, the stronger it will fasten itself to it; and that the same thing will happen with regard to two bits of chalk brought in contact with each other.

It is well known that the surface of a stone, prepared for a chalk drawing, is composed of

innumerable little points (art. 22), which file, as it were, the chalk, and receive on their surface small portions of it; but, according to the second observation, some force must be employed to make it adhere to the stone, and the greater the force the more it will adhere: the draftsman must consequently take care to present to the stone those parts of the chalk which have the greatest degree of cohesion; thus, instead of giving a sharp point to his pencils, he must avoid cutting them as much as possible; and if he is forced to do so by the fineness of the lines, it is better to cut the pencil in the shape of a wedge.

Independently of the different methods of cutting the chalk, there are also different modes of holding it; it may be brought from right to left, held vertically, inclined to the left, so that the point might follow last, or inclined to the right, so that its point might come first. Of all the different positions of the pencil, this last is the one which causes the chalk to adhere the most strongly to the stone; the more it is inclined like an engraving tool, the more certain one will be that the chalk may hold. In short, a better comparison cannot be found than that of a sharp stick, which on being pushed with its point foremost on a rough floor, will

catch every protuberance; whereas, if it is merely dragged, it will slip on without any difficulty. The chalk will also hold much better if the drawing is executed without going twice over the different parts, particularly with regard to the soft tints; for each elevation of the stone being charged with different particles of chalk, these cannot adhere so well (observation 1) as when the whole quantity of chalk is laid on at once. Thus it is evident that a drawing which is executed in a free and bold manner must be more successful than one which is often re-touched.

(48.) To resume. When it is wished to produce a great deal of effect, (art. 22) an artist must choose a stone of which the grain must be such as may be desirable for the foreground; he must then give, with a small glass muller and fine sand, different grains in different parts of the stone, according to the nature of the drawing and the effect he intends to produce. A stone thus prepared will be much more favourable to aerial perspective than one with an equal grain. The different parts, however highly finished, may be executed at once; success in the printing will be almost certain, and the grains which compose the lines will be in harmony with the several plans.

The pencil being cut in the shape of a wedge, the stone well covered with paper, the distances

may be first drawn, and care taken to hold the pencil firm in the hand, although it may be intended to touch the stone but slightly. When the point of the pencil is turned up by drawing, that part must be taken off with the fingers, as the firm part of the chalk alone must touch the stone.

(49.) Different methods may be employed to correct a drawing: if it is wished to make a dark line fainter, parts of it may be picked out with the point of the scraper (fig. 11); if a line is to be completely scratched out, the sharp part must be employed; but this must only be done in case it is not intended to draw on that part again, as this operation destroys the grain of the stone: if a considerable portion of the drawing is to be rubbed out, the glass muller and fine sand must be made use of.

Some Difficulties resolved.

(50.) 1. How is a sketch to be rubbed off the stone when executed with black or red chalk, or black-lead pencil?

2. If spittle, tallow, or any greasy substance have touched the stone, how is it to be remedied?

1. Wash the stone with a clean rag dipped in rain-water, until the lines have disappeared.

2. Rub that part with the muller and fine sand, and to be certain that all grease is destroyed, wash the part with a brush dipped in weak acid and water.

3. If some parts of the drawing are too dark, how are they to be made lighter?	3. Correct those parts with the point of the steel scraper: care must be taken not to go too deep in the stone, as these holes might fill with ink in the printing.
4. The extremity of the chalk becomes white; and although the first lines have marked on the stone, on coming over them a second time, they are detached from it.	4. The stone may have some dust on its surface, or the room is too cold. This may also proceed from the chalk being too hard, in which case it must be melted again, with the addition of some wax.

Precautions to be taken for Ink Drawings.

(51.) Ink drawings may be executed with the hair pencil, the common steel pen, or the steel pen, fig. 10, according to the style it is intended to imitate.

The hair pencil is used for all line drawings, writing, ornaments, maps, and landscapes: of all the instruments employed for these purposes this is the most useful: with the brush one may imitate the finest engraving, and the most delicate and sharp lines.

The steel pen is far from being equally good, but as it is more expeditious, it is often employed, particularly for broad touches; in short, the mathematical steel pen is used for all straight lines, and particularly for plans.

Whatever may be the nature of the drawing which is to be executed with lithographic ink, the stone may always be employed as it comes from the workman's hands; consequently there exists a great difference between the preparation of stones for ink and for chalk drawings, since in the former case the whole surface must be equally polished, while in the latter, the grain ought to be different in different parts (art. 48.)

As it is indispensable that the lines of an ink drawing should be as neat and as pure as possible, it is necessary that the stone should have the highest possible polish. Soft lithographic stones are not good for ink drawings, as they are liable to be scratched by the steel pens, and in general the hardest stones are by far the best: the delicate lines in ink drawings, and the light tints in chalk drawings, print much better with these.

(52.) We have remarked (art. 22) that three different modes were employed to produce aerial perspective: first, the different thickness of the lines; secondly, their more or less intensity; thirdly, the different grains of the stone. But from what we have observed above with regard to ink drawings, it will easily be seen that the third mode cannot be used, and that the draftsman can employ the two first only, in order to

produce with one colour the various tints of a drawing; the second even is hardly to be relied upon (art. 55.) This probably explains the reason why persons attempting this style of drawing have hitherto met with little success.

Etching on copper-plate has nearly the same disadvantage with ink drawings upon stone; but this defect is supplied by working the plates afterwards with the engraving tool and the dry point; for by means of these tools the smallest details, the most delicate tints for distances, and the darkest ones for the foregrounds, are easily produced. Ink drawings upon stone are far from offering the same resource; in general, however, they have the advantage of being freer and bolder than etchings.

This style of drawing is in great practice in Germany; the etching needle has also been employed with success, and it would be much to be wished that this latter manner were studied by eminent engravers, as by their practice in line engraving they might produce admirable specimens.

Mode of dissolving the Lithographic Ink.

(53.) Lithographic ink is employed in the same way as Indian ink; it must be dissolved by rubbing it in a saucer with a few drops of rain

water; hard or spring water must never be employed, as, by the salts they contain, they neutralize the alkali contained in the ink; it must be of the consistency of cream, and a cover must be placed on the saucer, to hinder evaporation, as otherwise the ink soon gets thick and slimy: if it gets too thick, a few drops of water may be added. The ink is still good; although it might have dried in the saucer, a few drops of water will soon make it fit for use.

Pen Drawings.

(54.) The stone being polished and well wiped, a sketch of the drawing must be made on it (art. 46.) A steel pen must be employed for hard stones, and a common quill for soft ones; it is often difficult to make the ink flow, and the surface of the stone frequently presents difficulties that are not met with when drawing on paper; but by a little practice and patience these difficulties are soon conquered. It is often necessary to wipe the pen, and even to wash it in water; it is also requisite to have a small piece of lead, on which a drop of ink is always kept: this will be found very convenient to freshen the ink which is in the pen, by now and then dipping the point in it.

Of Drawing with the Hair Pencil.

(55.) It is not possible to produce various tints with lithographic ink; the hair pencil is only employed to imitate line engravings, as with a brush one can produce much finer lines than with any other instrument.

The pencil is dipped in the saucer and then worked on a little piece of sheet lead, placed close to the drawing, in order to give it a fine point; this piece of lead is extremely useful, as it is necessary every instant to work the pencil on it, in order to hinder the ink from drying at the point.

The ink flows readily from a hair pencil, and if the lines are compared with those drawn with a pen, it will be found that the former are sharp and clean, while those executed with the pen are rough on the sides; this defect will increase in the printing.

It is necessary to inform artists who wish to execute a drawing with lithographic ink, that whatever be the instrument they employ, the lines must be well filled with ink, and, above all, done at one stroke; for once dry, it is very difficult to come over them again, and preserve their former sharpness: the different degradations must be produced by the dif-

ferent thickness of the lines, but never by different intensity of the tints; as, whether laid on thick or thin, they will all print equally dark: it must, however, be remembered, that those lines drawn full, with thick ink, will give many more impressions than when drawn with thin ink.

Of Drawing with a Mathematical Steel Pen.

(56.) These pens are chiefly used in drawing plans; they must be held perpendicularly to the stone, and after the ink has been put in with a brush, the points must be wiped externally with a rag; after which, they must be tried previously on a sheet of paper, and the screw moved until a line is produced of the desired thickness. When it is intended to draw very fine lines, all the abovementioned precautions must be taken very quickly, as, if done slowly, the ink thickens at the point and the pen will no longer mark; if, however, a dot can once be formed, the ink will flow easily afterwards: if all this does not succeed, the pen must be wiped, and fresh ink put in.

Although it is difficult at first to trace fine and dark lines with these pens, with a little practice a person will soon succeed, and lines may be produced as delicate as those of an etching.

As stones for ink drawings have a very fine polish, the ink must be employed rather thick, for otherwise it would be apt to run and spread; the broader the lines, the thicker the ink must be.

Of the Use of the Steel Scraper for Ink Drawings.

(57.) The steel scraper must be used very sparingly in chalk drawings, as the grain is always destroyed when this tool is employed.

It is however very different with ink drawings, for in this case, the scraper does not at all spoil the surface of the stone; thus, one may scratch out twenty times, if desired, give sharpness to the edges of a line with the scraper, divide it in its length or its breadth, separate two lines that have united together, and divide one into several parts or dots: in short, you may make use of this tool as much as you choose, provided the parts corrected are entirely taken out without going too deep in the stone.

Imitations of Wood-Cuts.

(58.) The ease with which one can use the scraper in ink drawings enables us to imitate wood-cuts with great facility in lithography.

The stone is covered with printing-ink, and the lights scraped out; those parts that are to be formed of fine lines are not covered with lithographic ink, but are executed after with the hair pencil.

Etchings upon Stone.

(59.) The stone having been previously polished, is washed in a solution of acid and water, and dried; a very small quantity of gum-water and black are laid on the stone with a rag, so as to form a thin coating. When this is dry, the drawing must be traced with red chalk and executed with etching needles; it must be remembered that these lines, or scratches, which of course will appear white, will seem much thinner when filled with printing-ink: this comes from an optical deception, proceeding from their change of colour from white to black: great care must be taken not to breathe on the stone, as this would dissolve the coating of gum. When the etching is finished, the entire surface of the stone must be rubbed with a rag and linseed oil, and afterwards the whole coating must be washed off with water. These etchings may be printed either with the roller or with rags, like copper-plates.

(60.) The skies and delicate touches of a

drawing might be done with the etching-needle, the thicker lines with the pen and hair pencil, and the fore grounds and darkest parts in imitation of wood-cuts.

Of Printing Lithographic Drawings.

(61.) We have now explained to the readers the various preparations the stone must undergo, and the precautions they ought to take in executing their drawing; we consequently suppose it ready for printing, and will now enter into a complete description of the process; but it is necessary to inform them, that from the difficulty of the operation, we think it impossible to detail it too minutely.

Of the Precautions to be taken before the Printing.

(62.) The artist who is at the head of a lithographic establishment must examine with great care the drawings that are delivered to him for printing; and before they undergo any previous preparation, he must modify them according to the knowledge he has of the stones, and of the chemical agents he employs.

In order to be understood, it is indispensable to observe, that the impressions on paper are

never exactly similar to the drawing on the stone; both the delicate tints and the dark ones change in their appearance: the artist will, however, recognise in them exact fac-similes of his original drawing, just as an engraver recognises his own plate in two unequal impressions. Since, then, a lithographic drawing changes its appearance in printing, it is very important to be enabled to foresee these changes, and to avail one's-self of them so as to obtain better impressions. This observation shows how important it is to have to deal with a good lithographic printer, who must necessarily be an intelligent artist, in order to succeed in his line of business.

(63.) We have seen in the preceding pages, that in lithographic stones, chalk, drawing and printing-ink, aquafortis, &c. were employed; but it must be remembered, the temperature of the air has great power over these different materials; there exists an intimate connexion between them, and they may be compared to a system of powers in equilibrium. Now it is known that if one of these powers is altered, in order to maintain the equilibrium, the relative force of the other powers must be also altered; in lithography it is the same: the different substances must be modified according to the stones, the

strength of the acid, and the state of the atmosphere: thus, for example, if the weather is warmer, the acid employed must be weaker and the printing-ink thicker. It would be necessary, even for a complete lithographer, to make numerous trials, if he finds himself in a foreign country, with stones and materials he has not before employed. Experiments must be repeatedly made, but it is necessary to make them the same day, in the same room, with the same inks and stones; otherwise one might be liable to attribute any failure to a wrong cause. Lines of different thickness and intensity and softening into lighter shades at one extremity, must be drawn on different stones, in order to find out whether the delicate tints stand the printing, and also those stones which are most favourable to the different styles. It will be necessary to make exact copies of these lines on a sheet of paper, in order to compare them with the impressions; by these means, a person will soon become acquainted with the difference produced in the printing, the various degrees of intensity the rollers can produce, and guess, in short, at the first sight of a drawing, the changes it will undergo, and modify it accordingly, if defective in some parts.

It will be observed, that in the beginning of

the printing, the faint tints become lighter than they were in the drawing, and the dark touches more intense; it is consequently necessary, before the stone undergoes any preparation, to obviate this effect, by making the faint tints darker. In ink drawings, it is necessary to examine with care, whether any of the lines are rotten, and whether in the dark parts, the thick lines are sufficiently distant from each other, to hinder them from uniting together; if they are too close, they must be separated with the steel scraper.

This article will explain why we cannot give precise rules for such or such a stone, and such or such a chemical agent, as it is impossible to know exactly the nature of those materials which will be employed: luckily, however, the general rules are always the same, so that after a few trials, all these difficulties will disappear.

Of Etching the Drawing.

(64.) The stone must be placed in an inclined situation in the trough (fig. 4), with the drawing towards the person; the small trough must be filled with rain water, in which a few drops of nitric acid must be poured, so as to give it the taste and strength of lemon-juice.

This etching water must vary in strength according to the stone, the warmth of the room, and the intensity of the drawing. A drop must be put on the margin, and if a strong effervescence, accompanied with noise, takes place, the etching water is too strong: water must be added until the effervescence diminishes, and begins only a few seconds after the acid is applied to the stone.

The small trough is then taken by its handle and the contents emptied against the upper part of the stone, so that its whole surface might be wetted at once; but as the stone is placed so as to form an angle of forty-five degrees, the water soon runs off into the large trough. It will now be observed, that while the water was running off, a number of small bubbles rose slowly from its surface, with a slight trembling noise and a smell of carbonic acid. If the bubbles formed themselves too quickly and the noise was easily perceptible to the ear, the etching water must be immediately weakened; if no effervescence took place, more acid must be added.

When the etching water has done running off, the stone is turned topsyturvy, and fresh acid thrown on it. The drawing must then be examined, by looking at it sideways, and if the

water recedes from some of the lines, as from a greasy surface, more etching water must be thrown on: this generally is sufficient.

As the etching water is thrown from the top of the stone, and allowed to run to the bottom, it is evident that an equal quantity passes over its whole surface, which would make it appear useless to reverse the stone; but we must observe, that the moment one has ceased pouring the acid, a small quantity is retained on the stone by attraction, and as this liquid always tends to run to the bottom, while the upper part dries, the acid is still acting on the lower part of the drawing.

The stone being now etched and still kept in the same position, a quantity of gummed water (article 26) is thrown on the stone, and having taken it out of the etching box, it is allowed to dry in a horizontal position.

(65.) The operation we have just described must be performed with quickness and precision: it must not take up more than half a minute. Its object is, first, to clean off the dust which, in graining or polishing the stone, may have filled up its pores; secondly, by corroding slightly the surface, to destroy those small greasy particles which might by accident

have adhered to the stone, and might thereby soil the impression; thirdly, by increasing the pores of the stone, to enable it to imbibe wet with more facility; fourthly, to render the chalk or the ink insoluble in water by means of the acid, which unites itself to the alkali contained in them: in short, the gum water is poured on the stone to fill up its pores and hinder it from receiving the printing-ink where it ought not. It is necessary to remark, that the acid must be stronger for ink than for chalk drawings.

However simple this operation may appear, it is extremely important for the success of the impressions; two risks are run in its execution, and it is by practice alone that they can be avoided. If the stone is not etched strong enough, it is apt to run smutty; and if etched too strong, the delicate tints disappear: the difficulty is increased by this circumstance, that the etching water which is proper for one stone is not so for another.

In general it is better to etch weak than strong (as this defect has its remedy), particularly for highly finished drawings; when, however, they are executed with spirit, or contain very dark parts, they may be treated with less precaution. This shows us that it would be better to pour but little acid on the delicate

parts and more on the dark ones; for it is easy to understand that the acid must attack the delicate places with much more strength than those which contain a great deal of chalk; besides, the faint tints, by their not being inclined to run smutty, do not require such strong etching as those parts which are covered with chalk. As the stone may be considered as a sort of cellulary tissue, easily penetrated by liquids, the closer these cells are to each other, the easier the communication; consequently the best way to hinder a greasy line from spreading is to interrupt the communication between these pores, and this is obtained by the effect of the acid, which, by slightly furrowing those parts of the stone which are uncovered, insulate, as it were, the lines of the drawing, and the water insinuating itself in these cavities, makes it much more difficult for the ink to spread.

(66.) Let us examine the manner in which etchings are executed on copper: when the etching is finished, and the first biting performed, those parts which are intended to be delicate are covered with varnish, previously to the second biting in: this may point out to us a better mode of etching for lithography. The

stone might receive the first biting, as explained above, and when dry, the delicate parts might be covered with some substance, soluble in water, but not so in acid, or until something better is found: gum water may be laid on with a soft brush, this coating allowed to dry, and the acid thrown on a second time, by which means the etching water would have had time to act upon the stone, before it could dissolve the gum water, which would thus preserve the more delicate parts: this operation might be performed as many times as necessary for the intended effect.

Of the Precautions to be taken by the Printer.

(67.) It has been seen in the preceding pages, that lithographic ink and chalk are employed as vehicles, to induce the printing-ink to adhere to the stone, and that it is this printing-ink which, by means of a strong pressure, is thrown off on a sheet of paper, and thereby produces the impression.

We suppose that the stone, having been previously etched, gummed, and dried, is placed in the press; we shall now detail the ensuing operations. The printer spreads some printing-ink No. 3, (art. 15), on the stone of the table,

(fig. 1), and seizing the roller (fig. 5), he works it in all directions, until the ink is perfectly well spread on its surface: he then takes a sponge, and, having dipped it in rain-water, and squeezed it well afterwards, passes it quickly over the gum, so as to wet its whole surface: having waited three or four seconds, to allow the surface of the gum to imbibe the wet, he gently applies the roller to the stone, to try whether it is sufficiently damp, and that it will not take the ink. When once he has been able to pass the roller over the stone without soiling it, he may proceed more boldly, and roll it in all directions.

If the gum is too wet, the roller will slip without turning. This, however, is immaterial: he must go on with a slight pressure, and slowly; and, by aiding the rotation with a gentle motion of the wrist, force the roller to turn. He will still, for some seconds, find some difficulty in doing this; but by degrees the water will evaporate, the gum will get thicker, and the roller will easily turn. In a short time the gum, which had hitherto preserved its transparency, will get soiled; and a dirty colour will spread itself over the whole stone. There is no fear now of the roller slipping: on the contrary, it will adhere strongly, and make a noise similar to that of two glutinous bodies separated from each other.

It now becomes necessary to wet the stone to be able to proceed: the sponge must be just wet enough to leave still a thin coating of gum during the operation, which must last altogether about a quarter of an hour. When it is found that all the lines of the drawing have been brought in contact with the ink, and that the coating of gum is extremely thin, the stone may be washed with great care, in order to clean off the grey colour which is spread on it; by which means the drawing will now be quite pure and clean: if a few black specks remain, they are occasioned by some lumps in the gum, and may easily be taken off with a steel point. A thin coating of gum must now be laid on with a brush, and the stone laid by for a day or two.

By what has been said above, it may easily be seen that the chief object in this operation is not to wash away all the gum, but, on the contrary, that it should preserve a sufficient degree of thickness, so that a coating might remain during the whole process. By thus preserving a coating of gum, all the lines of the drawing are, as it were, inclosed during this first application of the printing-ink to the stone; and, by this means, preserved in all their original sharpness. It is for this reason

that it is very important that the gum should merely be damp; for, were it washed off, the drawing might be completely spoiled. The stone is allowed to rest a day or two, in order to fix the ink in its pores; and this so completely takes place, that the drawing will not suffer, even if violently rubbed. It sometimes happens in this operation, that some parts are pulled up by the roller: if this takes place with chalk, it is difficult to make these places take the ink again; but with an ink drawing it is a very immaterial accident.

If it were desired to obtain impressions immediately after the stone is etched, the gum must be dabbed off very gently, while it is wet, with a soft rag, the drawing charged with printing-ink, and the impressions taken. This mode of proceeding may succeed with ink drawings, because, from being employed liquid, it sinks at once in the stone; but a chalk drawing being entirely superficial, several parts of it may disappear: it would always be far preferable to allow the coating of gum to dry after the etching. There is no inconvenience in printing ink drawings immediately after they are etched.

(68.) The thickness of printing-ink, for the above operation, varies according to the style

of the drawing: for ink drawings it is necessary to employ the stiffest ink (art. 15), and mix with it a sixth part of the varnish (No. 4.) This ink is so very stiff, that it pulls up the lines of the drawing: however, they shortly after take the ink again, and lines are obtained of the greatest sharpness.

If some parts of the drawing appear rotten, so that it might be feared that they would disappear, a thinner ink must be employed: however, it must never be forgotten, that the sharpness of the lines depends on the thickness of the ink.

For preparing chalk drawings, inks must be employed made with Nos. 3 and 4: the ink No. 4 must be taken for bold and sketchy drawings, the ink No. 3 for those which are more delicate; and, if the tints were extremely fine, it would be necessary to weaken it with the varnish No. 2: excess, however, in this respect, must be avoided with great care.

(69.) It has been seen that it was difficult to hinder the dark parts from getting still more so; and for this reason the use of thin inks must be avoided, particularly if the varnishes No. 1 and 2 enter in their composition. In preparing a stone for printing, a person may very often be much embarrassed; for, if he

makes use of an ink that is too stiff, the delicate tints are apt to disappear; and if the ink is too thin, it is true that the light tints remain, but then the stone soon wants keeping, and becomes monotonous: however, of the two evils, the former is most certainly the greatest. The safest mode of proceeding, in order to ascertain the proper thickness of the ink, is to trace on a separate stone some lines of the same tint as those in the drawing, to etch and prepare this stone in the same way as the other. If this one succeeds, one may safely charge the drawing with the same ink: lay on but a small quantity, and allow it to rest till the next day, when a stiffer ink may be employed to finish the operation. By this process one may be sure of preserving the delicate tints, without harming the general effect of the drawing.

When the ink is very thick, there is no fear of applying too much on the roller; but, if it is thin, the size of a hazel-nut will be sufficient.

(70.) The motion of the hands, when the roller is applied to the stone, must be nearly similar to the oscillations of a pendulum. The motion of the hands must also be the same in wetting the stone: and it must be remembered, that, the more delicate the parts, the slower the roller must be moved. Let us now suppose

the printer charging the stone with ink, and examine the different accidents that may occur.

1. *The stone has been wetted, and, notwithstanding, the ink soils it.*

Perhaps the stone has not been equally wetted; in which case a few drops of water must be sprinkled on, and spread with care. If, although the stone is rubbed with a sponge, the ink still adheres, the roller must be changed, and thicker ink employed; for, were one to proceed with an ink which produces this effect, the drawing would soon be spoiled.

2. *The roller slips on the stone, and it is impossible to make it turn.*

The stone is too wet: wring the sponge in a clean towel, or else go on rolling slowly, and squeeze slightly the handles, as if to impede its rotation, until the excess of water is evaporated. If the roller itself has too much gum and water on its surface, work it well on the small table.

3. *When the stone was prepared the gum-water was too weak.*

The coating of gum which covers the drawing must always be nearly of the thickness of a sheet of paper. If it is thinner, when the printing

begins, gum-water must be first used instead of pure water.

4. *The coating of gum which was on the stone has disappeared, and the surface of the stone is quite uncovered.*

Too much water has been used, or the stone has been rubbed too hard with the sponge: an accident like this would most certainly spoil the drawing: some gum-water must be immediately laid on, so that, during the whole operation, if the finger is applied to the stone, its surface might always feel sticky.

5. 1*st Case. The roller turns easily, notwithstanding the stone is covered with gum.* 2*d Case. The roller is quite besmeared with gum-water.* 3*d Case. The colour of the gum changes: the whole drawing is covered with a greyish tint.*

1st Case. This is the most favourable instant for charging the stone with ink: the roller must be pressed down hard, and passed with a quick motion all over the drawing.

2d Case. The ink and the gum, which are mixed together on the roller, act on the stone in the same manner as the mixture of gum and water (art. 17.) The roller is now in so favourable a state, that it would be totally im-

possible to soil the stone. We recommend the use of gum and ink thus mixed together to beginners: care must be taken, however, not to make too frequent use of it, as it would at last spoil the stone, from the ease with which this mixture unites itself with the ink.

3d Case. This tint must not be allowed to get too dark, as it might at length soil the stone: as soon as it appears, a few drops of water must be thrown on, and gently spread with a sponge.

6. *The printing-ink sticks to the edges of the stone.*

Several things contribute towards this accident: the aqua fortis acts less on those parts, and the gum adheres less to them also: when the stone is wetted, the edges always dry first. It is clear, then, that these parts must easily get soiled: they are, however, soon cleaned, by washing them with strong etching water, and afterwards with a little gum.

7. *Some portions of gum which are on the stone print as black as the darkest parts of the drawing.*

The gum has been badly strained, or some foreign substance has fallen on the stone: they

must be picked out with the sponge or the steel point.

8. *The dark parts of the drawing (if it is executed in ink) are taken up by the roller.*

This is of no consequence, as the lithographic ink always penetrates deeply into the stone, and this accident is only external: it may proceed, 1st, from the etching having been performed too slowly, by which a portion of the ink is decomposed; 2d, the gum is entirely washed off, by having employed too much water; 3d, the printing-ink is too thick; 4th, the roller has been rolled too quick.

It is always possible to make these lines again receive the ink, by passing the roller slowly over the stone, and leaning hard, or by raising the roller four or five inches from the stone, and letting it fall heavily on the parts which refuse to take the ink.

9. *The same accident takes place with a chalk drawing.*

This is a great misfortune; for, the chalk being entirely superficial, it is evident that, if it is taken up, nothing is left on the stone. This accident may proceed from the gum having been laid on too thick, so that in drying

it scaled and pulled up some of the lines. It rarely happens that the roller takes up a dark chalk line, unless there was dust on the stone, or the chalk was bad, or the room too cold. No other remedy is left, if there is any, but to charge the stone with the inks Nos. 1 and 2 (art. 15.)

10. *The delicate tints disappear.*

This may proceed, 1st, from the artist (art. 47); 2d, from the etching water being too strong (art. 65); 3d, from the ink being too strong (art. 68) : in the first case, where one fears that these parts will not hold, either from the artist's not having sufficiently observed the rules given in the art. 47, or from the room's being too cold, so that there is no affinity between the chalk and the stone, it must be put for a short time in some luke-warm water : for the second case there is no remedy * : in the third case, it is sufficient to employ thinner ink.

11. *In passing the sponge over the stone, a part of the ink spreads and comes off without*

* Chalk containing a much greater proportion of soap than usual, may in this case be often employed with success. —(*Translator's note.*)

soiling it, or spoiling the appearance of the drawing.

The ink is made with too thin an oil; a thicker ink must be immediately taken; for if in this case too much water were put on the stone, and the gum washed off, the thin oil of the ink would soon spread, and spoil the drawing. It is indispensable to remember, that in art. 26, the varnishes were classed under four numbers. If the accident we have just mentioned had taken place with the varnish No. 4, it would be evident that we had not been well understood, when we explained the method of burning the oil; and that the No. 4 of the printer would hardly be what we meant by No. 2; it would be consequently necessary to burn the varnishes again, until No. 4 applied, without black, to the stone, could not be washed off with the sponge.

12. *Notwithstanding every precaution, some parts of the drawing still refuse to take ink.*

These parts must be charged with a dabber*,

* These dabbers are made with long slips of linen about five inches broad; they must be rolled very tight, so that a small cylinder, five inches in length and of any given thickness, is formed; it must be tied round with thread, and

and if the ink will not take, it may be dipped in a little varnish, No. 4 ; some varnish may even be gently spread on the weak part with the finger, and allowed to remain a few instants; and as a last remedy, the mixture (art. 17) may be used, as, from the oil it contains, it may sometimes restore the part.

Precautions to be taken before the printing begins.

(71.) It is necessary, before the printing begins, to examine every part of the press, to see that the skin of the box (A B) be well stretched; to have ready a bason of clean rain water, an old sponge to clean the edges of the stone, another sponge to wet the drawing, a steel scraper, and a dabber.

The slab of the small table must be cleaned, pots kept ready, filled with ink of different thickness, made since some days ; the rollers

squared at one end with a razor: this extremity must be well rubbed in printing ink. This dabber is raised about three inches from the stone, and struck on it with some strength; if the drawings still refuse to take the ink, it must be gently rubbed on the part with a circular motion. When one has thus succeeded to make the ink adhere, the dabber must no longer be struck on the stone, as it would take up the ink again : it is necessary to wait some minutes, and sometimes even some hours, until the ink is perfectly settled.

must be soft and well stretched; some etching water, a clean rag to wipe the gum off the stone, must also be at hand; in short, every thing must be kept perfectly clean, for without the greatest neatness nothing good can be done in lithography.

OF THE PRINTING.

Mode of wetting the stone.

(72.) Three different cases occur, in which the stone is to be wetted:—1. when it has never been printed, and has undergone the preparation (art. 26)—2. when impressions have already been taken, and the coating of gum is dry—3. wetting the stone during the printing.

In the first case, a few drops of water are sprinkled on the stone, the gum is allowed to dissolve, and partly washed off with a sponge*; the roller is passed over the drawing, and an impression taken. When the paper is pulled up from the stone, it often sticks to it, and adheres so strongly as sometimes to tear; nevertheless,

* The sponges that are made use of may be coarse, provided they be soft; they must be free from sand or shells; they must not be of too close a texture, as these retain the ink too much. When dirty, they must be cleaned by boiling them in soap and water, and must be well washed afterwards.

the printing must go on, and the stone but little wetted, so as to leave some gum still adhering: this must be done until the paper no longer sticks, and the latter takes up every portion of printing-ink which is on the stone.

When the drawing was first charged with ink (art. 67) the nature of the lines was changed, as each became a compound of printing-ink and of chalk or ink (art. 67); by allowing the stone to stand for a few days, the printing-ink has acquired a certain degree of consistency, and an inclination to adhere to any thing which is applied to it; but this thick ink will gradually unite with that which is applied by the roller, until it comes clean off at every impression: in this state, the lines of the drawing appear transparent, and the stone is seen through them, which is not the case when the drawing is charged with ink. It is very important for the printer to be well acquainted with these two different states of the stone, in order to be able to judge whether it has received a sufficient quantity of ink or not, and whether any parts of the drawing have been forgotten.

Some lithographers, in order to clean the stone, instead of taking off a few bad impressions (as above recommended) wash the drawing with the mixture (art. 17): we are per-

suaded, however, by experience, that our method is by far the best.

In the second case, that is, when one has to wet a stone that has already been printed from, it must be allowed to soak for an hour or two in a tub of water. This gives time to the water to penetrate the stone in every part, and to dissolve completely the coating of gum. After this it must be carried to the press, and dabbed softly with a rag: a little gum-water must then be thrown on with a brush, gently spread with the hand, and again wiped with a rag, after which the stone is quite ready for printing.

The stone was placed in water that it might get completely damp; some fresh gum added, in order to fill its pores, and the gum wiped off afterwards, that it might not unite with the printing-ink, as we have already seen that this union would give a grey tint that would spoil the impressions.

In the third case, the stone is in the situation in which we have placed it in the preceding lines: it is now absolutely necessary that the gum should remain in all the pores of the stone, to hinder it from soiling, consequently it must be very little wetted, for the less it is wetted, the easier it is printed. The sponge must be squeezed in a dry towel, and a little

water sprinkled on the stone with the fingers, and spread equally on the stone with the sponge: by this means the stone will be damp, without showing any trace of water; and as it is often necessary to pass the roller at least thirty times over those drawings which are to have a great deal of effect, the wetting must be repeated whenever it is requisite, otherwise the ink would soil the drawing. If the roller makes a noise, and the edges take the ink, it is a proof that the stone is too dry.

If a great deal of water has been put on the roller, it imbibes too much, and refuses to receive any ink; in which case it must be dried.

Of the Lithographic Printer.

(73.) The preceding pages evidently show, that the art of lithography is a most difficult one; it is consequently earnestly recommended to those who wish to set up a lithographic establishment to select intelligent and clever printers; they must have some notions of drawing, and of what constitutes a good print; they must be able to distinguish the different plans of a drawing, so as to give it more effect in the printing.

A lithographic printer is a real artist, and all the impressions he produces bear the stamp of

his degree of talent; when he has wetted his stone, and has got his roller in his hands, he may be compared to an artist who is giving the last finishing touch to an Indian ink, or a Seppia drawing; like the painter, the printer must study the effect of his drawings, and distribute his ink accordingly. If the light and delicate parts have taken too much ink, he must barely touch them with his roller, while the darker parts must be passed over several times; in short, he must come with the whole weight of his roller over the foregrounds and the darkest parts; and when he judges by their appearance that these places have too much ink, by a particular motion of the roller he must be able to take off a part of it. (From art. 78 to 83.)

Mode of employing the different sorts of Printing-Ink.

(74.) This is the most important study of any for a lithographer. We have seen that these inks are composed of varnishes of four different degrees of intensity, and lamp-black.

If a sufficient quantity of black only is put to the varnish No. 4, to give it a colour, its density will be increased, and it will print better; if a sufficient quantity of black is added to the

varnishes No. 1, 2, and 3, so as to give them the same consistency as the ink No. 4, four inks will be obtained, in appearance the same, but very different in their effects. The analysis we are going to give of them is the most important secret of all lithography; it will explain to those who have already practised this art why one stone only out of ten succeeds; why nine stones which have cost infinite trouble have given nothing but spoiled impressions, while the printing of the tenth has proceeded with the greatest facility, and excellent prints obtained. If in this last case some persons are looking on, they will conclude that nothing is easier than lithography, and that it merely consists in passing the roller over the drawing, which receives, of itself, the ink in the necessary proportions, according to the quantity of chalk; to increase their admiration, they may themselves take the roller and obtain several good impressions: thus they depart under the firm persuasion that they understand the art, little suspecting that perhaps two hours afterwards, and without any visible change in the manipulation, the lithographer himself will be completely puzzled, and at a loss how to proceed.

The key of these extraordinary accidents,

which are the despair even of the cleverest lithographers, is to be found in the theory of the inks. It is necessary, consequently, to examine the nature of these inks, all of equal thickness, but made with varnish of different consistency, and containing different proportions of black.

(75.) The ink, No. 4, has all the qualities of the varnish it is made with: when rubbed between the fingers, it is unctuous; when the fingers are separated, it draws in threads like birdlime; in short, the cohesion between its component parts is such, that it never imparts its oil to the stone, and preserves the proper intensity of each line; consequently, whenever it is feared that the drawing is inclined to become dark and monotonous, it must be employed in preference to any other, and even sometimes for ink-drawings; it is, however, rarely to be used in this style, as this ink is so glutinous, that it is apt to charge the lines as if they were in relief and round, and the pressure flattening them, it is difficult to obtain pure impressions.

The ink No. 1, being made with thin oil and a great deal of lamp-black, is rough to the touch, its component parts do not bind together

and separate with facility; it easily imparts its oil to the stone, and must never be employed for chalk drawings, except in certain cases (article 67), when the faint tints are inclined to disappear.

(76.) Let us suppose that a new quantity of black is added to the inks No. 1, 2, 3, and 4, so as to make them all as thick as possible, and yet of equal density.

The ink, No. 4, will still preserve its nature; it will still be unctuous and glutinous, but the cohesion of its parts will be so strong, that when spread on the roller, it will pull up the lines of the drawing, as bread crum or Indian rubber clean lead pencil on paper, and if the stone is not sufficiently wet, and the ink adheres to it, it is sufficient to wet again and pass the roller over that part to clean it up: it must never be forgotten that good impressions depend entirely on this quality of strong varnish; for those inks which do not clean up of themselves the stains they have formed cannot serve for lithography, and this property may always be given to any ink, by the addition of black and of strong varnish.

These strong inks are proper for drawings which are inclined to become black or smutty;

but for common use, the chief talent of the lithographer consists in composing an ink, by the mixture of the different sorts of varnish and black, which may adhere with facility to every part of the drawing, and yet stiff enough to keep the stone clean; he must also be careful to stop the printing as soon as the ink ceases to produce the above-mentioned effect. Art. 105.

When the ink, No. 1, is fresh made, and has not been well ground, it dissolves in gum water and spreads a black tint on the stone; and although thick, it may still impart some of its oil; its component parts adhere but little together, and as the drawing by degrees acquires the property of the ink it is charged with, it takes it at last unequally and in spots.

(77.) This ink, No. 1, is much better when well ground and made some days before; it cannot, however, be employed for chalk drawings, as it fixes itself mechanically upon the stone (article 8); but a slight change makes it preferable to any other for ink drawings; this is effected by mixing with it a little of the varnish No. 3, which gives it more consistency, or if the ink is made with varnish-black (article 15), impressions will be obtained superior to the

finest copper-plate etchings in point of vigour and sharpness. This perfection of the impression proceeds—

First, From the thinness of the varnish, so that the ink is not raised on the stone, and consequently cannot spread under the pressure.

Secondly, From the ink containing a great deal of black, so that however thin it lays, it always prints dark.

Thirdly, From the great divisibility of the essence-black, which enables it to spread equally, however fine and delicate the lines may be.

From what has been said of the inks No. 1 and 4, we may easily understand the property of the inks Nos. 2 and 3.

The ink, No. 2, being less liquid than No. 1, does not impart its oil so easily to the stone, and is good for ink drawings.

No. 3 being less strong than No. 4, charges better the lines, and is very good for chalk drawings; mixed with No. 2 it may be employed both for ink and chalk. When stiff ink is used, it often accumulates on the roller to the thickness of the eighth of an inch; in which case a considerable quantity is consumed, and it appears to be composed of two distinct parts,

the one thick and liquid, the other quite hard; the liquid part charging the stone, and the other becoming hard and solid, which obliges you to change the ink the moment the lines receive it unequally and are no longer pure: when this happens, it must be cleaned up and fresh ground, either with some new ink or some varnish.

When liquid inks are employed, a very small quantity must be put on the slab, and the roller must never have more on its surface than the thickness of a sheet of paper, so that as much ink as would hold in a walnut-shell is sufficient to print five hundred large drawings. In general the longer ink has been made, the less inclined it is to soil the stone, and indeed to such a degree, that it would be difficult to make an ink, some months old, adhere to the drawing. The lithographic printer has consequently three means of giving consistency to his inks: first, by employing strong varnish; secondly, by putting more black; thirdly, by keeping the ink some time. The talent of the printer consists in properly employing these inks according to circumstances.

Of the Mode of managing the Roller for Chalk Drawings.

(78.) There are two modes of pressing on the stone with the roller, *vertically and horizontally.*

By the first method the roller is allowed to run freely in its handles, the chief power of the printer acting perpendicularly on the stone: it might be charged by striking on its surface with a printer's ball; in both ways the ink is applied with equal force on the summits and the hollows of the grain, and we shall see in article 79, how bad this practice is for chalk drawings; it tends to grease the stone and to produce a number of small dots which did not exist in the drawing, and give it a totally different appearance; and indeed a printer who understands his business never employs this mode of rolling.

According to the second method the leathern handles are strongly squeezed, as if it were intended to impede the rotatory motion of the roller; when the printer passes his roller on the stone, he employs his whole strength in a direction parallel to the stone, as if he wanted to make it slip on its surface: it is evident that if, at this moment, he were to hinder the roller

from turning, the summits of the grain would scratch off the ink which is on the roller, and by this mechanical action the drawing would receive too much black; consequently the printer must not squeeze the handles so as to hinder the roller from turning, but by practice learn to slacken or squeeze according as he feels the roller inclined to stop or to turn; he must thus bring it to the extremity of the stone, take it up, and roll again.

(79.) It will easily be seen by the above method, that by not using a vertical motion, the ink cannot enter the hollows of the stone, but must adhere strongly to the summits, which naturally resist any horizontal pressure, and it must be remarked that those faces of the summits which are opposed to the roller will offer the most resistance.

This leads us to a most important reflection; but it is necessary first to refer to the art. 47, in which we have observed that the draftsman, in making his drawing, generally brings his pencil from right to left, and that consequently the chalk adheres to the summit of the grain, in the same way as we have just shown that the printing-ink does; that is to say, that the summits take the chalk on those faces which are

opposed to it: from this we conclude that in charging a drawing with ink, the roller must always be worked in the same direction as the chalk, so that the horizontal pressure of the roller might act on the right side of the little cones which form the grain; otherwise, if the roller is pushed in an opposite direction, the ink is applied to the left side of the cones, which, as we have just seen, are covered with little or no chalk; so that all the talent of the printer cannot hinder that side from receiving a portion of ink, and by working the roller backwards and forwards, the greasy spot, which at first existed only on the right-hand face of the cone, will at last cover it completely; this must of course cause every dot which composes the drawing to spread, and must materially alter the impression. It is true that this accident does not destroy the drawing, but it certainly must change its harmony and keeping.

This explanation will appear still more important, when one considers that printers are naturally inclined to work the roller in that manner which appears to charge the stone the most, little suspecting how dangerous this practice must be; they obtain, it is true, strong impressions, but these soon get so dark that they are obliged to leave off printing: the only

remedy in this case is to allow the stone to rest some days (art. 101.)

(80.) From what has been said, it is clear that as the stone is placed in the press in the same manner as it was before the draftsman, it is necessary that the printer should always work his roller from right to left: it is true that this mode of pulling it towards him is not so convenient as to push it from him; but we have just seen how important it is to roll in this manner, and this receives more weight from the consideration that the wooden scraper of the press acts also from right to left.

(81.) The coarser the grain of the stone, and the bolder the drawing, the more important the above rules become; in which case it is absolutely necessary to work the roller in the manner we have just explained: but if the grain is fine and the drawing delicate, the summits only of the grain have received the chalk, in which case it becomes unimportant whether the roller is pushed from or pulled towards the printer (art. 103.)

(82.) Four methods are employed to make the ink adhere to the drawing, which we will designate by the following terms: first, by al-

lowing the stone to dry; second, by dividing the ink; third, by touching with the roller; fourth, by jerks.

1. The stone must be very little wetted: the roller is passed over the drawing and worked until the stone is so dry, that it is just on the point of soiling itself with the ink.

2. The roller is violently worked on the slab with a strong pressure: when this is done, if the roller is examined, the ink on its surface will appear very much subdivided, and, as it were, pulled up; when the ink is composed of strong varnish, this will become still more striking. This state of the roller is highly favourable to make the ink adhere to the drawing, and is the only mode of well inking in the dark parts. When the roller has been worked five or six times on the drawing, it becomes smooth, and no longer communicates any ink, so that if it is intended to roll in still more, the roller must be again worked on the slab.

3. Drawings that are to be charged with spirit must be done so with touches; that is to say, in the same way as a person ironing with an iron that is too hot: the roller must just graze the stone, and in touching it must describe a curve similar to the motion of an artist who draws a bold and free line. If the drawing refuses to take the ink, it must be

divided (No. 2.), and rolled on slowly with the handles held tight.

4. The roller is pushed by jerks on those parts which refuse to take the ink: if these parts are to be charged still more, the handles must be held quite tight, and the roller pressed both horizontally and vertically: after an instant's rest the roller is brought forward about half an inch, with a jerk; a few seconds after another jerk is given, and so on until those parts which are intended to receive a great deal of ink have taken it. One may also strike on the stone with the roller, but this mode is dangerous: at any rate the ink must be well divided first.

(83.) We have seen that a strong ink easily cleans up a stone; but there are other methods of doing it with a roller.

1. Taking up by rolling. 2. By touching. The first is done by allowing the roller to turn freely in its handles, with a quick and slight motion both backwards and forwards. The second, by slightly and quickly touching the stone, and also allowing the roller to turn freely.

In both these cases great care must be taken that the ink be not divided (art. 82. No. 2.): it must look shining and polished on the roller.

Management of the Roller for Ink Drawings.

(84.) Chalk and ink drawings are treated in a very different way; we have seen that the former were charged by impeding the rotation of the roller, while the latter must be charged by giving it a perfectly free motion: as the surface of the stone is polished, it is necessary to employ wooden handles; and the vertical pressure, which, as we have seen, must never be employed in chalk drawings, is the only proper one for ink: this proceeds from the surface of the stone being polished, which consequently renders a horizontal pressure dangerous, and would tend to spread the ink.

When it is desired to make the ink adhere strongly, it must be divided (art. 82. No. 2.), and the roller passed slowly backwards and forwards over the stone: in performing this operation no stiffness must be employed, and the handles so held as always to see the upper part of the hands, and yet the elbows must be lower than the wrists.

Similarly to chalk drawings, one may also *touch, roll by jerks, strike on the stone,* or *take up the ink by touching;* all is right, provided the roller be allowed to turn freely in the handles.

Of retouching Chalk Drawings.

(85.) If, during the printing, any part of the drawing disappears, the stone must be placed in water for five or six hours, and rubbed now and then with a sponge in order to dissolve all the gum: the stone is then allowed to dry during the rest of the day; and the next morning, the parts corrected, as if one were executing a new drawing. It must be remembered, however, that the faint parts must be drawn darker than they were at first. If the part that is to be re-touched allows it, a little fine sand must be rubbed on with a glass muller, and when the part is drawn in, it must be allowed to stand for a day; after which, the stone is slightly etched and gummed: this coating must be allowed to dry, or if it is rolled in while the gum is still wet, it must be very gently dabbed with a damp rag, and charged with ink No. 1 or 2. When it is certain that the part re-touched has taken the ink, a coating of gum is given to the stone, and it is allowed to rest another day before the printing is definitively carried on: re-touching is always a very difficult and doubtful operation.

Of retouching Ink Drawings.

(86.) Nothing is so easy to retouch as ink drawings; it is sufficient to scrape smooth the part which is to be retouched, without however going deep into the stone, after which the part is drawn in, slightly etched, gummed, and allowed to dry: if the parts retouched are slow in taking the ink, they must be charged with the dabber, (art. 70. No. 12.)

Of printing Chalk Drawings.

(87.) We suppose the stone to have been etched (art. 64.); that the printer has well examined all his implements (art. 71.); that he has prepared the stone for printing (art. 72.); in short, that the stone is completely ready. The printer begins by wetting the stone and well working the roller on the slab, until the ink is perfectly *divided;* after which he begins by rolling in at the upper angle of the stone towards his right, and holding the handles tight, *works the roller horizontally* until it has reached the lower corner to his left; he must then take up the roller and repeat the operation again.

(88.) The drawing is now uniformly inked in, and the operation is over for a common drawing; but for one which requires effect,

it is only prepared. The printer must examine the stone with the greatest care, and begin to act the part of an artist: if the delicate tints are not equally charged with ink, he corrects them by *touching:* he increases the pressure and the rolling in according to the darkness of the parts: in short, for the fore-grounds, which must be very dark, he often *divides* his ink, slowly guiding his roller over those parts, and, if necessary, employing the *jerk;* but as those parts which are dark are often close to those which must be faint, it is extremely difficult to succeed; and hardly one out of ten understands perfectly this process. He is obliged to turn his roller in every direction, to touch slightly the parts, and even to employ the angles of the roller: if this is not well done, the impression will be uneven, and the different workings of the roller will be seen.

During this process the stone is often wetted: if, notwithstanding this precaution, it were to take the ink in some parts, the roller must be immediately changed, and a stiffer ink taken to clean it up.

If, in the course of the printing, some of the dark touches appear inclined to run together, they must be picked out with the steel point (art. 50, No. 3); after which that part must

be washed with a small brush, dipped in etching water, and gummed.

The wooden scrapers of the press must always be made of a soft wood for chalk drawings, otherwise they would destroy the grain.

The box must be drawn out with a slow and even motion: if this were not done, the impression would be unequal.

The printer must be very careful to employ that degree of pressure only which is necessary to take up all the ink from the stone: any superfluous pressure is useless, and destroys the grain.

When the impression is taken, the paper must be slowly taken up, otherwise it might tear.

The prints, when dry, must be put in a press, or may even be sent to the hot-presser's.

Of Printing Ink Drawings.

(89.) The printing of ink drawings is performed in the same way as chalk: the chief difference consists in the mode of managing the roller.

In printing ink drawings, as we have already seen, wooden handles are employed; and we refer the reader to art. 76 and art. 74 for the management of the roller.

By examining all that has been hitherto said, it will be seen that, although the same means

may be employed, very different effects may be produced, and consequently that it is very difficult to obtain perfect impressions.

Thus, the stone must be wetted; but if, by the warmth of the atmosphere (which renders the evaporation too active), the stone must be too much wetted, the roller will imbibe water, and the ink will no longer take.

If the ink is too stiff, the drawing will not take it: if too thin, the impression, it is true, will be dark, but the stone runs the risk of being soiled.

A chalk drawing is composed of dark and faint lines: the first would require a stiff ink; but then this ink causes the faint tints to disappear: the latter would require a thin ink; but then the dark lines will run smutty. The delicate tints must not be rolled more than two or three times, for they would otherwise soon disappear; while the dark ones, if effect is required, must be charged several times: the former require but a slight pressure of the roller, while the latter must be rolled in with a great degree of strength.

By this it is seen that the printer meets with a series of oppositions, and that both long practice and a great deal of skill are requisite to overcome them. A clever lithographer is usually successful in printing a stone, but not for a length

of time, for, as he must naturally be anxious to preserve the delicate tints, the dark parts will at length become thick and smutty; and it requires no small degree of talent to obtain a thousand impressions from a chalk drawing. As for ink drawings, any number may be obtained: this proceeds from the smooth surface which is given to the stone, whereas chalk drawings are spoiled the instant the grain is destroyed. This consideration has always led us to believe that it will be extremely difficult, nay, even impossible, to find any substitute to stone for chalk drawings, compositions never possessing the same degree of hardness: we think, however, that they might do for ink drawings.

We have hinted (art. 66) at a mode of etching the dark parts of a drawing without touching the delicate ones. We believe that some thin substance might be found to lay on the light parts, while the fore-grounds are rolled in, and which would act, with regard to the ink, as the gum would with regard to the etching water. Thin sheets of copper, cut out according to the different parts, might be applied to the stone, so as to cover the light tints.

Another method would be to draw all the dark parts on one stone, and all the faint ones

on another: this, however, would be attended with a great deal of trouble, both on the part of the printer and of the artist.

Wooden scrapers of hard wood, such as box, may be employed for ink drawings. Metal ones must never be made use of, as they can never be perfectly adapted to the stone, and would either tear the leather or spoil the drawing, if any foreign substance should intervene between the leather and the stone.

The pressure for ink drawings must be greater than for chalk: the box must also be drawn out quicker.

OF THE ACCIDENTS WHICH OCCUR DURING THE PRINTING.

(90.) *The impression is pale, although the drawing looks dark on the stone.*

Increase the pressure of the scraper, until it takes up all the ink.

(91.) *The impression is uneven and spotty.*

The first care of a printer, as soon as an impression is taken, must be to examine attentively the stone: if the ink has been entirely taken up, it is a proof that the drawing has been badly rolled in; but, if the faint parts of the impres-

sion are dark on the stone, and vice versa, the unevenness of the impression is no longer to be attributed to the mode of rolling in, but may proceed from the following causes:

(92.) *The impression is incomplete: an entire part of it is wanting.*

The stone, or the scraper, are not level: if this accident proceeds from the stone, some paper must be pasted on the leather of the box (AB: see fig. 13.)

(93.) *Some parts of the impression are quite pale.*

Some hollows must have been formed in the leather by foreign substances: paper must be pasted in them.

(94.) *The impression is marked in its whole length by light streaks.*

The scraper is certainly notched: it must be made straight with a plane.

(95.) *A number of dark and faint lines mark the impressions in different directions.*

This can only proceed from bad management of the roller; it may also be caused by its being too hard, in which case more flannel must be laid on it.

(96.) *When the drawing has been charged, the lines look quite pure on the stone, and yet in the impression they appear ragged.*

The printing-ink is too liquid; it spreads beyond the lines by the pressure: by passing the sponge on the stone the lines will recover their original sharpness, but a stiffer ink must be immediately taken, or the stone would be spoiled.

If the lines are of some breadth, and it were impossible to employ a stiffer ink (art. 105), it is possible to hinder the ink from spreading by drawing out the box quicker; this is even the only method of obtaining clear impressions when there are parts which are very much covered with ink, as is the case in imitations of wood cuts.

(97.) *The lines of the impression are ragged, and appear to have spread all in one direction.*

This defect may proceed from four different causes: First, from the ink being too thin: this may sometimes be remedied by passing the sponge over the drawing, after it is inked in, and before the impression is taken; secondly, from the stone not being well fixed in the box; thirdly, from the leather not being well stretched, whereby the paper shifts on the

stone; fourthly, from the paper not having been sufficiently struck with the hand (art. 28), so that it stretches under the scraper; if it proceeds from this cause the lines will be most ragged in that part of the impression on which the scraper acts last.

It is often difficult in ink drawings to hinder the paper from slipping on the stone, particularly when the sheet is large, in which case it must not be laid on, but fixed in the upper frame, which last (by means of the hinges) must be placed at about a quarter of an inch from the stone, so that the scraper might act gradually on the paper.

(98.) *The stone seems inclined to run smutty.*

Roll in with the ink No. 4, and if the drawing already appears much soiled, the following remedies may be used:

First, Take a little etching water or vinegar in the hollow of your hand, and rub gently on the smutty part.

Secondly, Put a few drops of acid in the water with which the stone is wetted.

Thirdly, Etch it again, as explained in article 64.

Fourthly, Pick out the dirty parts with the steel scraper, article 50, No. 3.

(99.) *The stone imbibes water with avidity; it becomes dry an instant after it is wetted.*

Immerse the stone in a tub of water for some time, and in printing make frequent use of gum water.

(100.) *The stone having been laid by for a fortnight, the lines refuse to take the ink.*

The drawing had been rolled in with common printing ink, instead of using the ink mentioned in article 16: this may sometimes be remedied by washing off the old ink with the mixture, article 17.

(101.) *Very fine impressions are often obtained during one or two days, when, all of a sudden, the drawing changes, the lines get thick, and the whole drawing dark, so that the printer is forced to leave off; and yet when the stone has been allowed to rest a few days, it prints as well as before.*

We have already seen that the printing-ink always tends to dry, so that if too long a space of time is allowed, it will not take any fresh ink, and the thinner the coating of ink is, the sooner, of course, it will dry; now, as this spreading of the lines is entirely superficial,

these parts after a few days will lose their power of receiving ink.

(102.) *When the stone is inked in, the roller looks shining and polished, in which state it inks badly, and can hardly be worked on the slab.*

The stone has been too much wetted, so that the roller has imbibed too much water: it must be allowed to dry.

(103.) *The stone is perfectly clean and only damp; after the roller is passed over it, it appears damper than it was, and is covered with a grey tint.*

First, The roller is wet.

Secondly, The printing ink is not sufficiently ground, or the varnish is too thin; a thicker one must be employed.

(104.) *Having made use of a thin ink, and wishing to take a thicker one, this last will not adhere to the roller, although it has been well cleaned.*

The roller must be allowed to rest a few days and another taken.

(105.) *It often happens that during the printing, without any apparent cause, the drawing refuses*

to take the ink, so that the printer cannot proceed.

Put the stone in water for a few hours, after which allow it to rest some days.

The lines of a drawing, and the ink with which it is charged, may be considered as two glutinous substances applied on each other; when these are separated, the one which has the most consistency will retain a part of the other, if their consistency is the same, and that which is in greatest quantity will attach itself to the other, which is in a smaller proportion; thus the greasy lines of a drawing will not receive printing-ink, unless the former have more consistency than the latter, or if their consistency is the same, the roller must be charged with more ink; but if by some cause or other the consistency of the lines of the drawing is not so great as that of the printing-ink, the roller, on the contrary, will take up the grease of the drawing.

Thus the whole question appears reduced to this: to give to the printing-ink a consistency equal to that of the drawing; but here another difficulty arises, for we have seen (article 72), that the stone must not be much wetted, so that a liquid ink might attach itself to the stone; there exists, consequently, a degree of density

of the ink which cannot be exceeded; thus if the ink has the necessary degree of thickness not to soil the stone, and yet has so much density that it takes up the lines of the drawing, the printing cannot proceed.

If we call A an ink just liquid enough to soil the stone, so that by the least addition of a stronger ink the printing might be carried on; and we call B an ink just stronger than the lines of the drawing, so that by a small addition of thin ink an impression might be obtained, we will have in the two inks A and B the extremes of thickness and thinness of the printing-inks; consequently it becomes evident,

First, That any ink more liquid than the ink A, and thicker than the ink B, cannot be used for printing.

Secondly, That the inks of which the thickness is not so great as B and not so liquid as A, are the only ones that can be employed.

Thirdly, That the ink which would be a medium between A and B would be the best of all.

This being well understood, let us now suppose that the temperature of the room increases; the heat will in a manner liquefy the greasy lines of the drawing, and diminish also the consistency of the printing-ink B; but as the rela-

tive consistency of these two bodies will always be the same, their reciprocal affinity will not change with the temperature of the room: this would not be the case however with the ink A, for as the increase of heat would increase its thinness, and at the same time the water would evaporate more quickly, the ink would attach itself much more easily to the stone, and its affinity with the lines of the drawing would be greater, so that if A is to be the limit of the thin ink, its density must be increased.

If the temperature increases still more, the consistency of the ink B will still diminish with that of the greasy lines of the stone, while the ink A, from the necessity of thickening it, will increase in consistency; thus the more the difference betwixt A and B diminishes, the more difficult the printing will become; and at last, if the temperature rises still more, so that A and B become the same, it is evident that it will be impossible to print any longer; that is to say, that an ink, that would be so thin that it would soil the stone, would notwithstanding be stronger than the lines of the drawing.

It must not be concluded, however, from what has been stated above, that it is impossible to print in very hot weather, for it must be remembered that the printing only becomes

impossible when the lines of the drawing are as thin as the ink A; so that if a drawing is taken which has more consistency, either because it has been charged with a strong ink, or that, by having stood some days, the lines have acquired more density, the printing can be carried on. Thus in summer both the inks and chalks must be harder, and the varnishes thicker.

The accident we have just described will happen chiefly when the printing is begun in a cold room, of which the temperature is gradually rising. It is very important to understand well this phenomenon, and we are more persuaded of this than any other person, as we shall never forget that it was only after four months' continual failures and laborious researches, that we found out that a stove placed too near the press was the cause of all our misfortunes. Consequently, it is desirable, if possible, always to print in a cool place, and if the stone gets too warm, it must either be put in a cellar, or allowed to stand for a few days.

The above article serves as a key to several accidents which we had not hitherto explained: for example—1. Why, when the stones are prepared for printing (art. 67) it is necessary to

allow the stone to stand for a few days after, particularly when a thin ink has been employed, in order to preserve the delicate tints.

2. Why, in the above-mentioned preparation, the varnishes Nos. 3 and 4 are preferable to Nos. 1 and 2, particularly when one is desirous of printing directly, without allowing the stone to stand.

3. Why, when the lithographer has began printing with too thin an ink, which soils the stone and makes the dark parts run smutty, he finds it so difficult to make a thicker ink adhere to the stone.

4. Why the same ink which is proper for one stone is not so for another; in short, why those stones that do not print well one day, succeed perfectly well another, which makes the printers say that the stones are capricious.

Of making Transfers.

(106.) The stone is prepared according to the style of drawing which is to be transferred, and some spirits of turpentine passed over its surface, after which it is heated to about 130, Fahrenheit. When the stone is sufficiently warm, the back part of the transfer paper, on which

the drawing has been made, must be slightly wetted and placed between some sheets of soft paper for a few minutes; the drawing is then placed on the stone, with the face towards it, and it is drawn out, slowly two or three times (with a slight pressure at first) and increasing the pressure each time. When the stone is cold, some weak etching water, and afterwards plenty of pure water, must be thrown on the paper; as soon as it is well soaked, it must be gently taken up, and if the operation has been successful, the ink or the chalk will have left the paper, and be fixed on the stone: this latter must be then treated as if the drawing had been made on the stone.

It has been seen (art. 18) that a mucous substance is laid on the transfer paper, which hinders the ink from penetrating it; this latter is slightly wetted, in order that the paper should apply better to the stone; the stone is heated, in order to open its pores and incline it to receive the ink; in short, when the stone is cold, water is thrown on to destroy all connexion between the ink and the paper, by which means the ink remains firmly attached to the stone.

We have now completed the treatise on lithography, but must beg leave to observe, that

having been ourselves bewildered by the numerous lithographic compositions which were given to us, we are persuaded that we have done a real service to the reader by giving but few recipes, and those only which we have found by experience to be the best.

MEMOIR ON LITHOGRAPHY.

PART IV.

When a person wishes to speculate on a new art, it is necessary that he should be thoroughly acquainted with the whole process, compare this art with those which are analagous to it, to be able to judge of its utility, and compare the expense of the process, that he might judge whether it has any advantage in point of economy. We have consequently thought that it might interest many persons to have a comparison laid before them of lithography with copper-plate engraving.*

* As lithography has hardly yet been used in this country by booksellers and printsellers, it is impossible to state the expenses in English prices; however, as when this new art will be thoroughly established in England, the relative expense of copper-plate engraving and of lithography will bear pretty nearly the same proportion as in France, a comparison may easily be made.—*Translator's note.*

Comparison of Lithography with Engraving.

(107.) The extreme facility with which drawings are made upon stone, and their being in fact original, give a great advantage to lithography over engraving: but, on the other hand, it must be confessed that, in point of beauty and perfection, nothing has been hitherto produced to be compared with fine line engraving.

Good engravers are extremely rare; it often requires many years labour to finish a fine plate; and it is on this account that we see but few fine prints, and that so many ordinary engravings are to be met with. It is this class of prints that lithography will most certainly supersede; and when we compare the stiffness of prints to the ease and freedom of lithographic drawings, there is not the least doubt that lithography will become a most valuable substitute to the secondary class of copper-plate engravings.

When expense is a consideration, it will be seen that lithography is by far preferable to every style of engraving. Hitherto the greatest part of the lithographic productions are chalk drawings: the reason of this is, that artists have not sufficient patience to attend to all the minutiæ of an ink drawing; and as engravers (who by profession would be the most success-

ful in this style) are naturally the last to encourage lithography, no superior specimens in ink drawings have hitherto been laid before the public. The collection of lithographic prints of the School of the Roads and Bridges, in Paris, may be compared with the best copper-plate engraving, in point of sharpness and high finish.

The drawings and plans of the public works executed in France had hitherto, from the great expense of engraving, remained buried in portfolios: thus a number of ingenious and useful inventions were lost. It was proposed to form an association amongst all the engineers, by the rules of which the drawings were to be executed on stone, instead of being done on paper; and a mutual exchange to take place. This plan has succeeded beyond all expectation; and as this society is at present composed of 150 engineers, and consequently 150 impressions of each drawing are required, we will make this the basis of our comparison; every drawing being one foot five, by ten inches and a quarter.

(108.)* The price of a copper plate, large enough for a drawing of the above-mentioned

* For the convenience of the reader, the French prices have been converted into English money.

dimensions, is from three and ninepence to four and twopence a pound. They are sold again, when worn out, at one and eightpence.

A plate of copper, twenty inches by twelve, costs one pound five shillings: it may be scraped twice; this will cost about twelve and sixpence; and when old, may be sold for twelve and sixpence: consequently, as the same plate may serve for three drawings, each will come to eight and fourpence.

A letter engraver charges two and elevenpence for a hundred words in small Italics, and five shillings, if small Roman type.

Capital letters are charged as for a word; thus the letters necessary for the explanation of one of the drawings of the collection would cost, on an average, eight and fourpence; and a clever engraver would ask at least two pounds two shillings for the simple etching.

A German stone, two inches thick, and large enough for one of the drawings, costs twelve and sixpence;* a stone loses about the fiftieth

* Thanks to the excessive liberality of our government, the prices of stones can bear no proportion in the scale with those mentioned in the French text. In other countries, but particularly in France, the government has stepped forward, and endeavoured to encourage, both by protection and money, the introduction of this useful art: here, on the con-

part of an inch every time a drawing is rubbed off, so that one stone may serve for about thirty drawings.

The expense of executing one of the drawings of the collection is five shillings; and for writing the explanation and words, half-a-crown; thus we may form the following table:—

Copper-Plate.	£	s.	d.
Price of Copper .	0	8	4
Etching the drawing	2	2	0
For engraving the letters . . .	0	8	4
	2	18	8

Lithography.	£	s.	d.
Cost of the stone for one drawing	0	0	3
For making the drawing . . .	0	5	0
For writing the words . . .	0	2	6
	0	7	9

trary, it was immediately looked upon as an object of revenue, and the enormous duty of twenty shillings a hundred weight laid on lithographic stones; thus nipping lithography in the bud, by raising the stones to an exorbitant price. Nor can it be alleged that this is done to encourage the working of our own quarries, for no good lithographic stones have hitherto been found in England, and were there any to be procured, the quantity of stones required for lithography is always trifling in comparison with what is required for building, paving, &c. Lithography in France is already become a considerable branch of commerce with other countries, and the immense sums of money which the sale of English prints have brought into this country might give us full room to hope that lithography would become equally productive;

The above expenses are the same, whatever may be the number of impressions.

	£	s.	d.
Printing 150 impressions, at 5*s.*7*d.* per hundred	0	8	4½
Paper	0	5	10
	0	14	2½

	£	s.	d.
Printing, at 3*s.* 4*d.* per hundred .	0	5	0
Paper	0	5	10
	0	10	10

According to the first part of the above statement, lithography is about seven times cheaper than copper-plate engraving; and even then a great part of the expense may be saved, if the person executes his drawing himself.

To make the comparison still more striking, let us suppose that any number of impressions are to be taken, to which we shall add the first expense of engraving the copper, and making the drawing on stone; this expense being the same, whatever the number of impressions may be.

however, at present, the high price of stones here must give a decided superiority to our neighbours. A German stone, of the dimensions mentioned in the text, would cost (all expenses included) only nine shillings; in London, with the duty, it comes to 1*l.* 7*s.*—*Translator's note.*

Number of Copies.	Engraving.			Lithography.		
	£	s.	d.	£	s.	d.
150	3	12	10½	0	18	7
300	4	7	1	1	9	5
600	5	15	6	2	11	1
1,200	8	12	4	4	14	5
2,400	14	6	0	9	1	1

We have stopped at 2,400, because an etching on copper is generally worn out after having given that number of impressions; whereas an ink drawing on stone can give any number of impressions:* but if more than 2,400 impressions are wanted, the plate must be engraved, which adds £2 18*s.* 8*d.* more in the balance against engraving.

The above comparison clearly shows the immense advantage of lithography over engraving, in point of economy; there is no doubt that when clever artists and engravers will try to execute highly-finished ink drawings or etchings on stone, specimens will be produced that will rival the best copper-plate engravings, and

* Etchings on stone, from the facility with which they are done, the fineness and purity of the lines, and the expedition in printing, are likely to prove far more useful still than drawings in lithographic ink.—*Translator's note.*

these will have the advantage of being executed with much more ease and rapidity.

The facility with which lithographic drawings are executed, as this does not require a long and previous study, like engraving, enables any person, who can handle a pencil, to produce any number of impressions. This renders lithography of inappreciable advantage to several branches of manufactures, such as coach-makers, upholsterers, clock and lamp makers, goldsmiths, &c.: it will also be highly useful for copies of writing, for music, models of machinery, &c.

(109.) A wonderful property of lithography is the possibility of multiplying fine engravings, ad infinitum, by means of transfer.

The process we are going to describe was invented by Mr. Le Gros, of Anesy, well known in France by several important discoveries.

An impression of a lithographic drawing, or of any copper-plate, is taken on a sheet of thin, but well-sized vellum paper: the instant the impression is taken it is thrown in a bason of clean water, so as to swim on its surface: a stone must previously have been prepared (either grained or polished, according to the style of drawing) washed with spirits of turpentine,

and heated, as for a transfer. When the impression is well soaked, one of the extremities of the paper is placed on the stone, and it is gradually and gently pressed down with the roller (fig. 6) until the whole print is applied to its surface: the paper is taken up, and the print will have left the paper, and fixed itself to the stone; this transfer must undergo the preparation of a common drawing.

It is difficult for those who have not witnessed the operation to imagine the perfection with which it can be executed. Mr. Le Gros has transferred before us an impression from a highly-finished copper-plate, and so perfect were the impressions from the stone, that it was quite impossible for any of the by-standers to distinguish the copy from the original. This experiment evidently shows that a clever engraver is only wanting, in order to produce lithographic drawings, or etchings, equal to copper-plate engraving.

By this process, any indefinite nnmber of impressions may be obtained, for it is only necessary to make transfers on several stones, to obtain hundreds of thousands of impressions.—Several transfers of small prints may be made on the same stone, by which means an immense saving in the expense of printing will be ob-

tained; or if a great number of impressions of any important paper were suddenly wanted, several impressions might be thrown off in a few moments on several stones, and given to be printed in different presses.

(110.) We have seen, in art. 58, how wood cuts could be imitated; by a similar process, flat and coloured tints may be applied to lithographic prints. Take of

Wax, two parts,
Soap, one part,
A little vermillion:

Melt these in a saucepan, and when dissolved, cast in sticks. This must be worked in a saucer till it acquires the consistency of cream: a coating of this is applied to a stone, and when dry, a transfer, from a fresh impression, must be made on this coating: if lights are wanted, the coating must be scraped away where the lights are intended: the stone must now be etched with acid, in the proportion of one part of acid to twenty of water; after which the whole must be washed off with turpentine, and printed as an ink drawing. Care must be taken, when the drawing is executed, to make two small dots in the margin, which must be printed in every impression, and these dots be printed

also on the coating in the transfer, and carefully preserved. These dots are absolutely necessary, to bring the prints to correspond in the second application on the tint plate.

By employing several stones, very fine coloured prints may be produced.

(111.) It might, perhaps, be possible, by employing chemical affinities, to print in colours with one stone alone. A red chalk might be made, for example, which would have an affinity with a certain ink, a blue chalk with another ink, and so on. Another method might be employed, which would be to use gummed silk, stretched out on frames; to cut out holes in these according to the different colours, and, by applying them to the stone, to leave uncovered those parts only which are to be charged with a certain ink: we have not the least doubt that beautiful specimens might be produced by this process.

(112) We have seen that very fine etchings were executed on stone: Mr. Duplât has employed a similar process to produce admirable imitations of wood cuts, which have been employed by Mr. Renouard, in his edition of the Fables of La Fontaine.

He covers the stone with a greasy varnish, scraping away those parts which are to be white, and, executing with a brush the lines which are to be very fine, he etches with a strong acid, until the lines of the drawing are much in relief. When this is done he casts on the stone some metal, and beats it with a hammer, in order that it might enter the cavities of the stone still more accurately: this matrix serves as a mould for casting forms which are employed by the printers, like wood cuts.

We have now communicated to the public all that we have known of lithography, and doubt not that any intelligent person, by following the rules that are given in this book, will be almost certain of being successful.

There is every reason to hope that France, the country which has always cultivated the fine arts with the greatest success, will also be the one in which lithography will attain the summit of perfection; and that this highly useful art will increase the produce of our industry, multiply the masterpieces of our artists, and render the rest of the world our tributary.*

* Our decided superiority in engraving, and the undoubted talent of our artists, give every reason to expect that Mr. Raucourt's prediction will not be fulfilled.—*Translator's note.*

THE END.